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What to Make and How and Where to Sell It

By K. H. Condit
Editor, *American Machinist*

TWO of the hardest questions the manager of any metal-working plant, large or small, must answer are what to make and where to sell it. Many a company and individual has failed because the answer he got for one or both of these questions was not the right one. Neither hunches nor traditions are safe guides to follow in seeking the answers; only facts will do, and they must be analyzed intelligently. Some managers do not believe that they have a marketing problem. They think that because they have agents in several centers they can let the agents worry over that end of the business while they devote their efforts to production. Others are equally sure that their worst difficulty lies in engineering, or finance. They may be quite right in their feeling but it often happens that a marketing study will show the way to the solution of a pressing financial, engineering or production problem. Take the case of a manufacturer with idle plant capacity. He thought that to get more business it would be necessary to lower his selling price but when he studied the question from a marketing viewpoint he found that he already had all the business he could possibly get from the fields to which he was selling. If he had lowered his price he would not have attracted a dollar's worth of new business, the only result would have been a cash gift to each customer. His problem was not a production problem but one of finding some new product to make.

But how is one to tell whether he is doing a good job of marketing or not? What can he use as a yardstick? Perhaps the best way to measure himself is by finding out his standing in the industry he serves—the recognition achieved by his product and his name. Let us see why recognition of this sort is important.

A study has been made of the standing of nearly one thousand companies with their customers in industry. Fig. 1 shows the results of the study. It was plotted from average figures obtained as follows: Several thousand actual buyers were asked to name the companies which they considered as leaders for certain products, twenty-five in number. In this way the first, second, third, etc., companies, measured by the acceptance of their fields, making each product were determined. The percentages of acceptance for all the firsts were averaged; all the seconds; and so on down the line. From the curve, which has a break just below the fifth position, we can say that a manufacturer has probably not won recognition unless he stands fifth or better in his field. If he stands below fifth the chances are that he has less than ten per cent recognition. His position is weak and he might better concentrate his efforts on some product where he stands better than fifth, assuming that he has one. It may be that he has too many products and must spread his sales effort too thinly. Concentration is indicated.

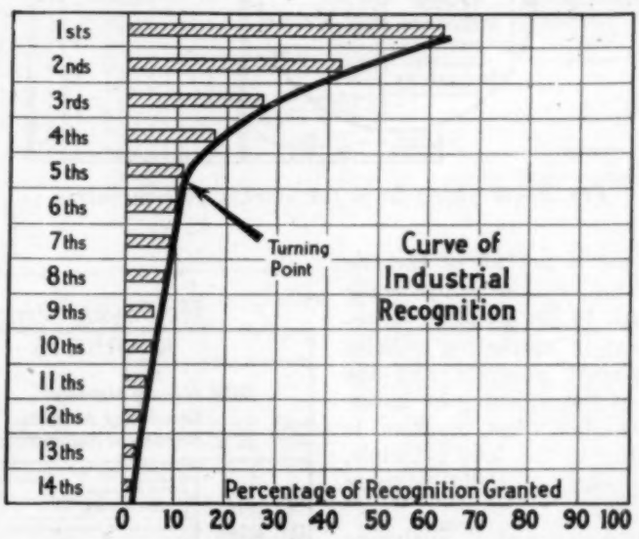


Fig. 1—Recognition—the foundation of marketing strength

Other points brought out by the survey were that the age and size of the company does not necessarily bring recognition, nor does high quality alone. The

Fig. 2—Ten control steps for industrial marketing

leaders, without exception, were recognized as specialists in the particular product studied. Another interesting point was that recognition is not won by companies as companies. A concern may rank first with one of its products and fifteenth with another. But, how to get recognition? It can be done and there is a system, consisting of ten steps, for doing it. The ten steps, and their relation to the four general principles of industrial marketing, are shown in Fig. 2. Every successful manager knows the four principles of industrial marketing although not, perhaps, by the names given in the illustration. And he uses some if not all of the ten steps whether he realizes it or not, so that we are really only reducing accepted practice to its simplest terms.

As indicated in the illustration marketing policies are determined from the market analysis and the studies of the buying habits of the industry or industries involved. The first of the ten steps, markets, is obviously the one corresponding to the first principle, market determination. How shall we go about carrying it out?

To one who has had little experience at it, analyzing a market looks like a stupendous task—but it is surprisingly easy when approached in a systematic fashion. Experience with the marketing problems of many manufacturers has shown the marketing counselors of the McGraw-Hill Publishing Company, Inc., that often 90 per cent of the work can be avoided if the first step taken is the elimination of all markets that are obviously not worth while. To do this most easily requires a form like that shown in Fig. 3 on which checks can be made to indicate primary, secondary and recommending markets for each of the products considered.

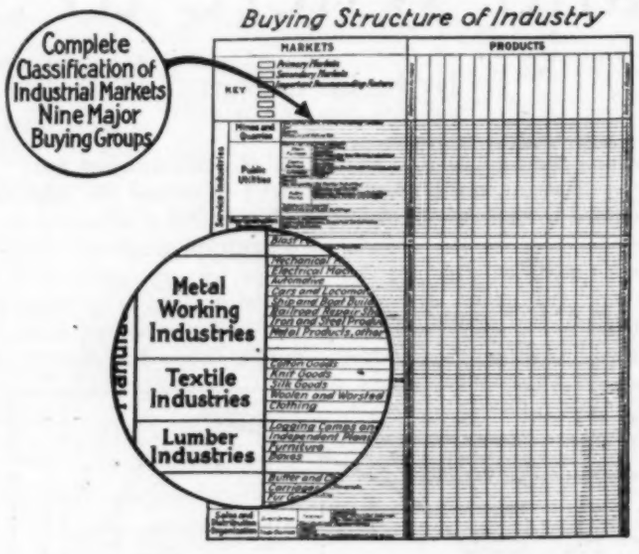


Fig. 3—Working form for market determination

But how can we decide which markets are worthy of further study and which are not? One way is to draw on the experience of the manufacturer himself and of his associates. The Census of Manufactures will give some clues. Valuable figures are available in the leading business papers. For instance, electric motor markets have been studied by *Electrical World*, Diesel engines by *Power*, machine tools by *American Machinist*.

The machine tool inventories of various industries are being published twice a month. From them reliable estimates of markets not only for machine tools but for such accessories as chucks, cutters or grinding wheels can be worked out.

If no quantitative figures are available it is always possible to determine whether the product under consideration can render a service in a given industry, and how important that service is. It often happens that results so obtained are more valuable than the quantitative studies because they are likely to open up neglected markets. The next illustration, Fig. 4, shows how a manufacturer worked out a market determination for a group of products, A, B, C and D. Note that there is no uniformity in the usefulness of the various products in the fields shown in the fragmentary chart. Naturally, therefore, a sales plan that would serve for one would probably be useless for the others. He found that each one must stand on its own feet and be treated as an individual problem. Companies that are marketing their products as a "line" without regard to the individual sales possibilities of each item would do well to make a similar study. Now for the other three steps connected with the determination of marketing policies. Step two is

The Buying Structure of Industry

MARKETS		PRODUCTS				
Key: Primary Markets; Secondary Markets; Important Recommending Factors		A	B	C	D	E
Public Utilities	Electric Light & Power					
	Steam Railways					
	Electric Railways					
	Automotive Transportation					
	Marine					
	Public Works					
Mines	Coal Mines					
	Metal and Non-Metallic Mines					
	Petroleum and Natural Gas					
Power Plants	(Private and Central Stations)					
Construction	Engineers and Architects					
	Construction Companies, Contractors					
Process Industries	Acids, Chemicals and Chemical Preparations					
	Brick and Clay Products					
	By-Product Coke					
	Drugs, Medicines, and Cosmetics					
	Explosives					

Fig. 4—How a manufacturer located his markets

to find out who does the buying. Here is another fine opportunity to go astray. Some manufacturers have the fixed idea that the man they want to reach has the title "designing engineer." That designation specifies his duties well enough but it is not the title of the man responsible for these duties in the great majority of cases. He may be called chief engineer, designer, engineer, or chief draftsman and yet he performs the same duties in each case. It should be plain, therefore, that what we should try to run down are responsibilities, not titles, for the same confusion exists all through the industrial structure as indicated in Fig. 5, which was drawn up by finding out who purchased the products listed on the left in representative industrial plants.

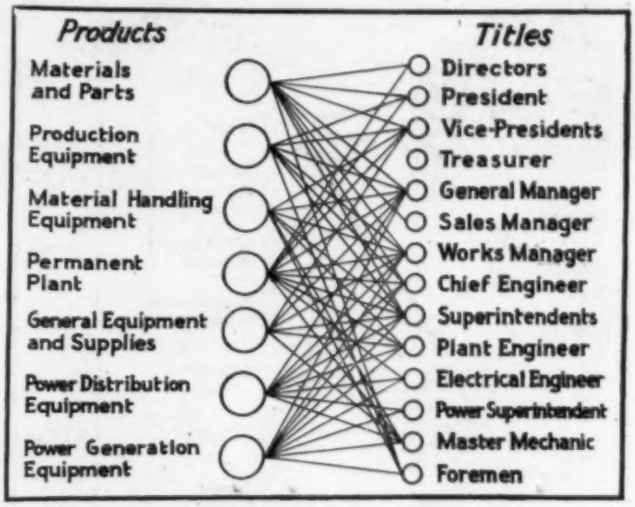


Fig. 5—Confusion of titles in industry

A method of classifying buyers by responsibilities is shown in Fig. 6. The chart shows, further, that buyers naturally fall into two general groups: those who think in terms of their own industry, or in some specialized function in an industry, such as textile men or automobile men—forming what may be called a vertical group; and those who head up some function common to all industry, such as plant engineers, power engineers, electrical engineers—termed a horizontal group. In some cases it is hard to draw the line between these two groups in the manufacturing plant and that situation is indicated by the overlap in the chart brackets. An example of how a manufacturer tied up his product with the buying groups to which he had to make his appeal is given in Fig. 7. Note the difference in the two products checked. In one case the designer was the most important man to sell, with the sales manager and the production manager also interested; in the other the man in charge of power distribution was the deciding factor, with the chief of power generation also interested. The whole sales approach for the first case would have to be absolutely different from that for the second case. It is now possible to build up the prospect list for the product and then to decide on the most suitable type of sales organization. The type of sales organization that can best sell any group of buyers depends after all on the actual services the buyer expects from the seller when he makes the purchase. To get at the proper sales organization it is convenient to list the types of sellers just as was done with the buyers and place opposite to this list a list of services sought by buyers, as shown in Fig. 8. This chart shows what services were demanded by buyers of two products, *X* and *Y*. The three demands relative to product *X* indicated clearly that the employment of specialists would give the proper sales effort. The local service demand predominant in the case of product *Y* pointed the way to jobbers and supply houses as the outlets.

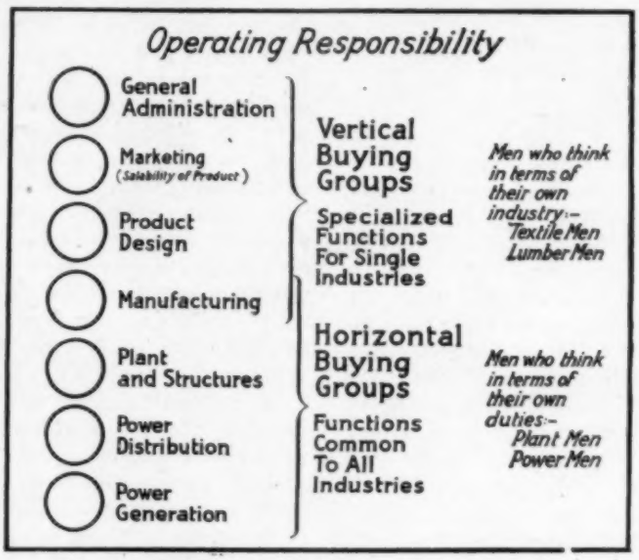

Operating Responsibility
General Administration
Marketing (Salability of Product)
Product Design
Manufacturing
Plant and Structures
Power Distribution
Power Generation
Vertical Buying Groups
Specialized Functions For Single Industries
Horizontal Buying Groups
Functions Common To All Industries
Men who think in terms of their own industry:— Textile Men Lumber Men
Men who think in terms of their own duties:— Plant Men Power Men

Fig. 6—Industrial buying control determined by responsibility

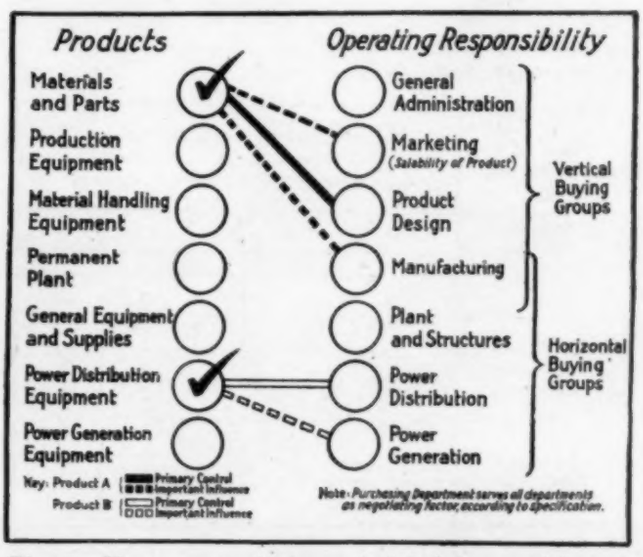


Fig. 7—How a manufacturer isolated types of buyers for his products

Now that the steps rounding out the marketing policies have been disposed of, steps five and six covering the sales organization follow very logically. They are the first of the six steps leading to the marketing plan. The territorial plan is of course determined automatically by the geographic location of the markets selected. And the personnel is likewise controlled automatically by the service requirements of the buyer.

Suppose, for example, that the product is an automobile camshaft grinder. Obviously there should be a sales office in Detroit and the product should be sold by specialists in grinding with a wide acquaintance among automobile production men. If the manufac-

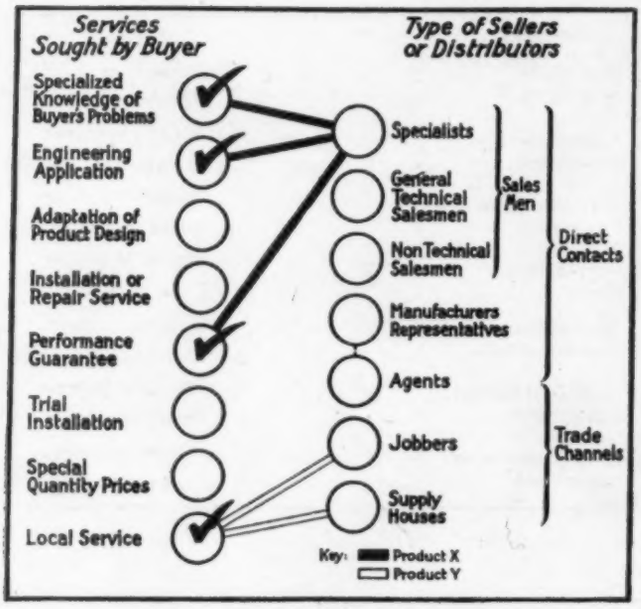


Fig. 8—How a manufacturer chose suitable types of salesmen and distributors

turer is represented by an agent in that territory the specialists will be on the agent's staff.

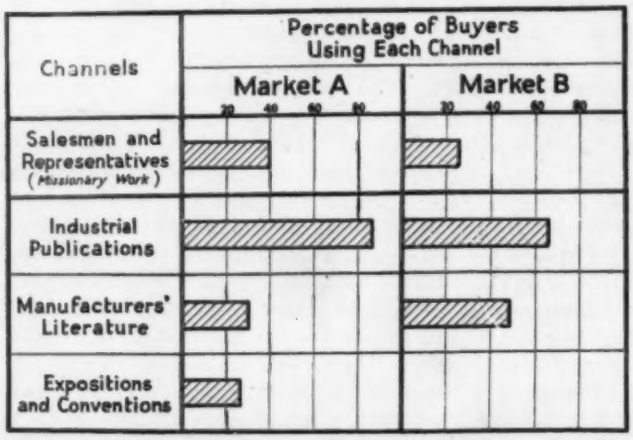
So much for the sales organization, the front-line troops. How are they to be supported? Here comes in sales promotion which includes the remaining four steps in the working plan. Steps seven, eight and nine should be considered together because they represent the means available to the manufacturer for telling his story to industry. These steps are publication advertising, manufacturers' literature and special promotion, such as exhibits and conventions, and they are designated as the channels of approach. To these efforts must be added, of course, the direct missionary work of the sales force, a particularly important factor in the equipment field.

The next question that faces the manufacturer is the evaluation of the various channels of approach so that he can get the most worth from his promotion appropriation. The best guide is the extent to which his customers use each channel of approach to keep informed on equipment, materials and supplies.

A manufacturer of electrical products got the answer to this question by sending out men from his advertising department to interview responsible men in plants typical of each market. What they found out is portrayed in Fig. 9. The bar for the salesmen indicates the percentage of plants in which they can profitably do personal missionary work, of course they can secure the orders in practically every case. It should be remembered that market *A* is for a high-priced engineering product while market *B* is for a lower-priced product that is handled as a supply. From the illustration it will be evident that the promotion appropriations must be divided quite differently for the two products. The more expensive product can be shown to advantage at exhibitions and conventions while the other one cannot. Likewise, the direct contacts by salesmen and representative are more valuable in the case of the more expensive product than for the other one. Manufacturers' literature, on the contrary, is more effective in the case of the cheaper product. Publication advertising is the most effective channel of approach for both products, but more so in the case of the higher priced one.

Before deciding on promotion plans step ten must be considered. It is essential to know what buyer-interest keynote will be most appealing before we set up a promotion campaign. Here again buyers in different markets seek widely varying information on the product. An example showing the relative importance of the three types of information most generally desired by buyers is given in Fig. 10. In the two markets just mentioned it was found that performance data led by a wide margin in both. Design and construction details were far more interesting to the buyers of the more complicated and expensive product than to the buyers of the cheaper, simpler one. Conversely, service facilities were twice as important in the case of the cheaper product. Obviously, this is not necessarily a general rule.

In the beginning it was said that recognition for a product was the achievement most likely to promote profitable marketing and reduce sales resistance. As a check on the soundness of the ten-step plan just described a survey was made to discover to what extent it has been applied by leaders in various industrial fields. One hundred of the leaders were studied and all of them have applied the principles of the plan to some extent. They have actually done about 65 per cent of a complete job, most of the shortcomings falling in the group of sales appeals. The trailers, on the other hand, are doing less than a twenty per cent job. The reason why they are trailers seems evident.



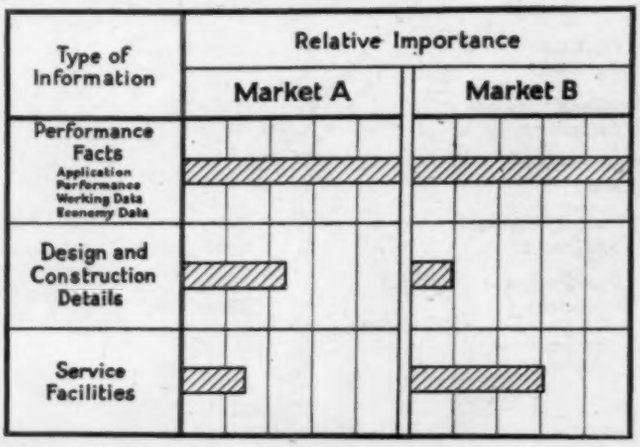


Fig. 9—Sources through which buyers in two markets keep informed on equipment. Fig. 10—Kinds of information sought by buyers in two markets

Static and Dynamic Balancing

By ARTHUR K. BURDITT
Editorial Staff, American Machinist

The growth in importance of dynamic balancing methods—Old and present-day methods used in static balancing—How the balancing machines are used

THE art of balancing is one of the more recently developed branches of machine shop practice. Dynamic balancing was perfected only with the advent of such high-speed mechanisms as steam turbines, electric motors and automobile engines. One of the earliest really scientific treatments of dynamic balancing was published in 1906, on page 240, Vol. 29, of the *American Machinist*. The author of this article was E. R. Douglas and the article is said to have led C. H. Norton to take up the subject of balancing. The Norton running balance machine was first described in Dec., 1909, on page 1023, Vol. 32, of the *American Machinist*. It was long known that the vibration of machines and mechanisms was usually caused by the unbalance of its rotating parts. It has not been so long, however, since the difference between static and dynamic balance was fully realized. Static balance is obtained when the center of gravity and the center of rotation are made to coincide. Dymanic balance is obtained when the principle axis of inertia is made to coincide with the axis of rotation. In balancing, the words standing and static, and running and dynamic are frequently used almost synonymously although there might be made a slight distinction. Standing balance methods will determine only the "static" unbalance of a part. Running balance methods are required in order to reveal the "dynamic" unbalance of some part. Theoretically, the only rotating objects that can be balanced satisfactorily by standing balance methods are those of which every point lies in the same plane geometrically. Running balance would be required, theoretically, for any object of which not all of the points lie in the same place. In other words, any object that is to revolve and that has width will be subject to dynamic unbalance and will require the running balance methods to correct this unbalance. Practically speaking, however, any object, such as a disk, that is comparatively thin can be balanced satisfactorily by the standing methods. The most common and simple method for securing static balance before the development of balancing equipment, was to place the pulley, for instance, on a short axle upon parallel and level ways. Naturally, the pulley will turn until the heavy side is at the lowest point. A refinement of this same method is the use of level knife-edge ways, so long as the pulley is not heavy enough to destroy the knife edge. Another method for determining the unbalance of objects in the "disk" class is the "cone" method. In this case two truncated cones with their small ends facing each other are inserted in the bored hub of the pulley to be balanced. The cones are suspended from a bar or chain with a universal joint at the cones so that the heavy side of the pulley which, in this case, is supported with its axis vertical instead of horizontal, can be determined. Both of these methods were refined, by the use of special equipment, so that the guess work was considerably reduced. In the first case, where the axis of the pulley was horizontal, the refinement consisted of mounting the pulley and axle on a supporting unit that acted, in effect, as a pendulum. The pulley and axle were supported by a V-crotch at each end of the axle. The two crotches were, of course, connected by a bar so that they formed a single unit. At each end of the unit a knife edge supported the crotch. A weight suspended from one of the crotches was adjustable to keep the center of gravity of the unit just below the knife edges. To the other crotch was fastened a pointer which swung down over a scale as the supporting unit swayed on the knife edges. Fastened to the same crotch that carried the pointer was a long beam that carried scale pans. The wheel was turned a quarter or a sixth of a revolution at a time and weights applied to restore the pointed to the "O" point on the scale. The cone system was modified in a manner similar to the previous case. The axis of the pulley was vertical and the pulley was supported so that it could be rotated and at the same time rock. Weights were used to keep the center of gravity below the knife edges and a pointer was again supported from the unit. Many machines have been brought out within recent years, for determining static unbalance and some of these combine with them a drilling spindle. One very recent machine for determining the static unbalance

Fig. 1—The Micro-Poise static balancing machine for flywheels

of flywheels and pulleys, built by the Commerce Pattern Foundry & Machine Co., Detroit, Mich., is illustrated in Fig. 1. The flywheel is mounted on an adapter. The adapter has in its base a ball, and the unit can be raised or lowered onto a flat plate. On top of the adapter is built in a universal level. When the entire unit rests on the ball, the heavy side can be balanced by means of weights.

Another machine for static balance has the pulley or wheel mounted with its axis horizontal. This machine, built by the Tinius Olsen Testing Machine Co., Philadelphia, Pa., is shown in Fig. 2. The machine is of the scale type. When the wheel to be balanced is mounted on the balancing spindle at the right, counterweights are used to equalize the unit as it rocks on knife edges at the center of each supporting column. The balancing spindle is motor driven at a rate of four times a minute. As the wheel is revolving on the spindle, the entire supporting unit will rock according to the position of the heavy side of the wheel. The long vertical pointer indicates the ounce-inches of unbalance and the amount indicated when the pointer reaches its maximum is next removed from the appropriate point in the wheel.

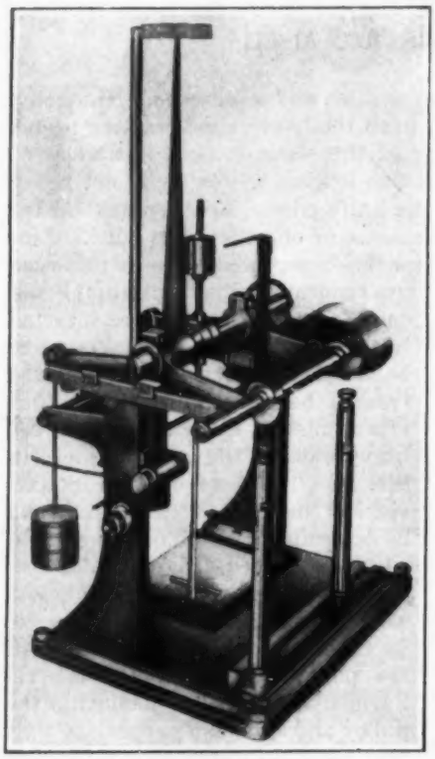


Fig. 2—Olsen motor-driven machine for static balancing

It will be seen that the two machines described above are typical examples of the two methods for static balancing that were mentioned in the beginning of this article, the method where the shaft of the wheel is horizontal and that where the axis of the wheel is vertical. But when the radius of the object is short in comparison with the length of the axis, we have the "drum" rather than the "disk" class. As soon as the width of the wheel is comparatively great, "dynamic" balancing is necessary to place the object in a satisfactory condition of balance.

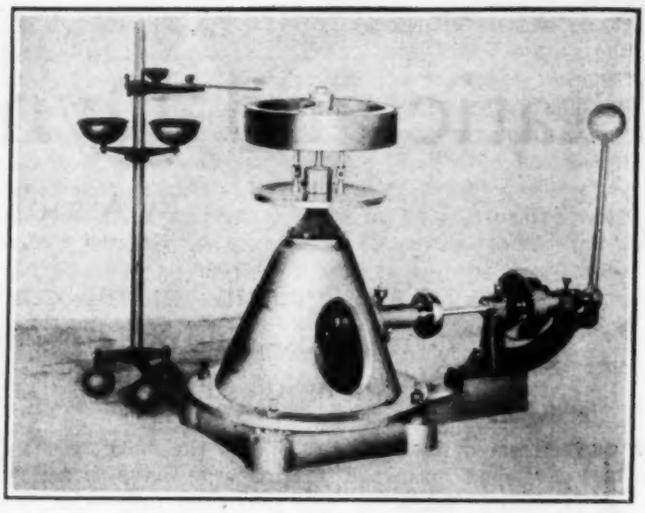


Fig. 4—The Defiance machine for flywheel balancing

An object has been placed in dynamic unbalance if a couple has been introduced while correcting the static unbalance. The condition of a couple exists when two heavy points in a "drum" do not lie in the same plane. These two points may be of the same weight, equidistant from the axis and diametrically opposite, but if one of the points is at one end of the cylinder or drum and the second is at the opposite end, the cylinder will be in dynamic unbalance though it is statically in balance. There can be all manner of variations and combinations of heavy points but in order to have the object in running balance the principal axis of inertia must coincide with the axis of rotation. The inertia of two points in different planes and diametrically opposite each other, will give a twisting or spiral tendency.

The original method for balancing high-speed turbine rotors was fundamentally to place each disk of the rotor in static balance. With the development of the electric motor and high-speed engines, however, dynamic balancing and more accuracy became increasingly important. Automobile crankshafts in static balance, for instance, were far from balanced when actually running at a high speed. One of the earliest machines in the dynamic field was the Norton running balance machine shown in Fig. 3. This machine, built by the Norton Co., Worcester, Mass., consists fundamentally of two pedestals and a connecting bar. The bar carries a number of standards to support the piece to be balanced. At the top of each support is a set of interchangeable trunnion rollers upon which the crankshaft rests. The crankshaft is belt driven. The rollers are directly mounted on an

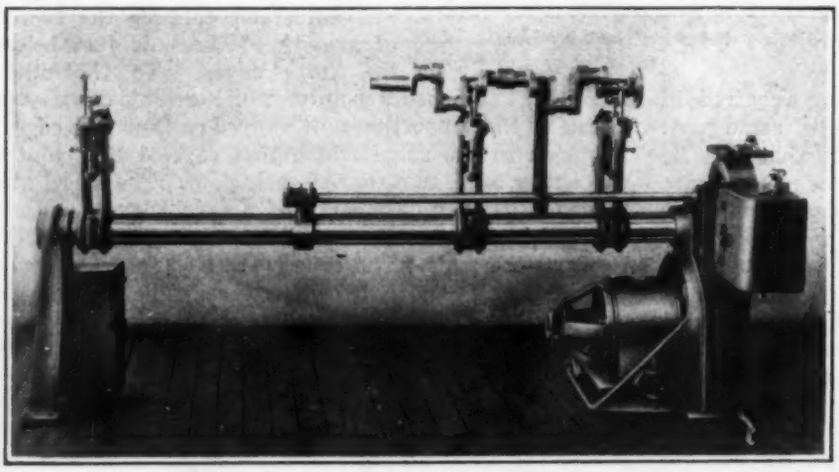


Fig. 3—Balancing a crankshaft on the Norton motor-driven running balance machine

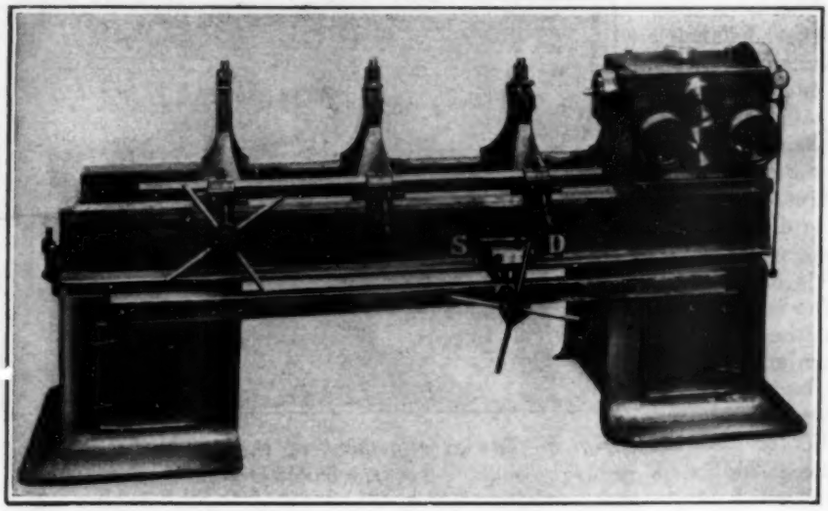


Fig. 5—Olsen-Carwen static-dynamic balancing machine

inverted pendulum. The magnitude of the vibrations is increased by this multiplying lever, one of which is agitated by each trunnion roller, so that they can be more readily compared by the operator of the machine.

The method for locating the heavy and the light sides of the piece is to apply marks at the ends of the shaft. The marks are applied by means of color rollers attached to the standards. The colors used are Indian red lead or Russian blue. When the piece is rotated below the critical speed, the marks will appear on the heavy side and when the piece is operated above the critical speed the marks will appear on the light side. The reason for this is that the centrifugal force of the heavy point will tend to spring or to raise the piece at this point. The actual raising or springing, however, lags behind the heavy spot and this lag increases as the speed of rotation increases. After the speed of rotation has reached and passed the critical speed of the piece, the lag becomes so great as to cause the indicating marks to appear on the light rather than the heavy side of the piece. The piece to be balanced is run first in one direction and indicating marks applied, and then it is reversed and again marked. This method is used because of the lag of the marks. The true heavy point, therefore, will be determined by the point midway between the marks. While the crankshaft has been cited as an illustration, the machine is equally adapted for balancing drum pulleys, flywheels, etc., in the same manner as the crankshaft is balanced. A flywheel balancing machine that also depends on the marking of the piece is the one shown in Fig. 4, and built by the Defiance Machine Works, Defiance, Ohio. In the case of this machine, the object to be balanced is first supplied with a balancing plug having a conical cavity at one end, that is fitted into the bored hole of the pulley slightly above the center of gravity and which rests upon the conical point of the vertical spindle. Driving fingers rotate the piece until the proper momentum has been obtained and then drop away, leaving the wheel free from contact except with the point on which it rests. Before rotation, a weight held with moistened clay is placed in a position near the center of the interior of the rim so as to produce a standing balance. The piece is then rotated and marked upon the edge of the rim with a pencil of moistened clay. If the mark occurs within one-fourth of the circumference of the wheel from the weight, in the direction of rotation, the weight is moved toward the mark. If the mark is more than one-fourth the circumference from the weight, the weight is depressed and moved away from the mark. An entirely different principle is used in the case of the Olsen-Carwen static-dynamic balancing machine built by the Tinius Olsen Testing Machine Co., Philadelphia, Pa. This machine, illustrated in Fig. 5, is similar in appearance to a lathe. The part of the machine that corresponds to the bed of the lathe, however, is placed on two pairs of fulcrums, one pair placed so that the bed can rock sideways to show static unbalance and the other placed so that the bed can also rock endways when determining the dynamic unbalance of the piece. When determining the static unbalance of the piece, the machine is used with the knife points on the side withdrawn from contact with the bed so that the bed will rock only sideways.

The object to be balanced is supported in the standards provided with the machine and is driven from the balancing head. The vibration of the piece tends to rock the bed of the machine. The unbalance itself is counteracted within the balancing head by means of a unit that is adjustable so that it can be set out of balance to exactly oppose the unbalance of the piece. This adjustment is secured by means of the dials on the side of the head. Since the adjustment will secure an equal and opposite reaction, the dials will at the same time indicate the position at which the corrections and the

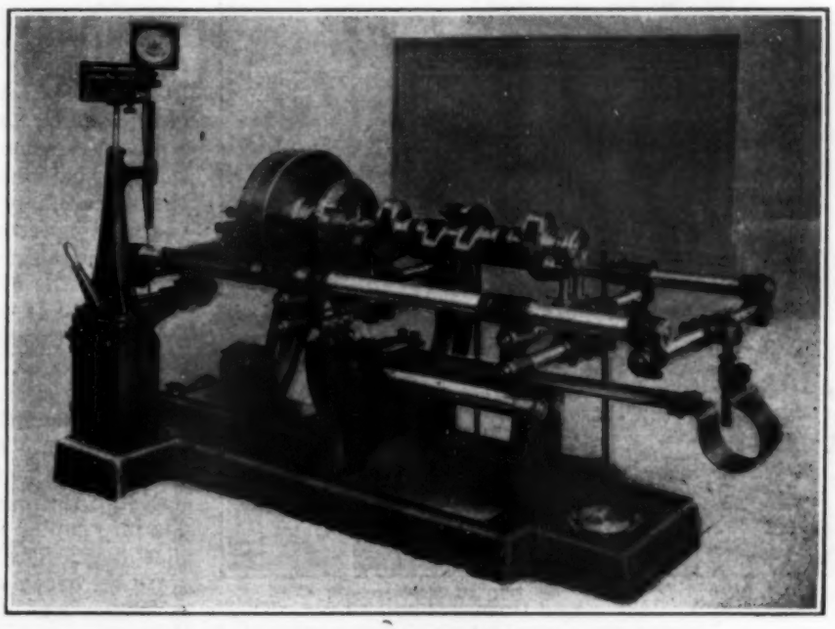


Fig. 6—The Gisholt universal balancing machine

amount of correction are to be made. The same company also builds the Olsen-Lungren flywheel balancing machine, which operates on the same principles except that it is a vertical machine instead of horizontal.

Another machine making use of the same principles is the one shown in Fig. 6, built by the Gisholt Machine Co., Madison, Wis. This machine has but one pair of fulcrums. The method followed is to first correct the outer end of the piece. The inner end is directly over the fulcrum of the frame so that it has no effect on the vibration of the frame. The piece is next turned end for end and the process repeated. The unbalance is counteracted by means of the flywheel at the left. The flywheel is split through its circumference and the outside section carries a weight which can be adjusted in a slot to the desired radius from the center. The vibrating frame has attached to it an indicator. As the frame vibrates, the extent of the vibration is indicated. Each graduation represents an ounce-inch when multiplied by a certain constant determined for each piece.

The weight on the flywheel is then set at the equivalent point and the outside section is moved to the angle where it will exactly counteract the unbalance of the piece. This angle will be the one at which the correction is made. The readings during the tests are made only at the speed of resonance which is the period at which the time for one revolution of the piece exactly equals the natural period of the frame. It is at this point that the amplitude of vibration is largest.

The Akimoff static and dynamic balancing machine built by the Vibration Specialty Co., Philadelphia, Pa., shown in Fig. 7, is another machine using the same general principle of operation as the two previously described. The Akimoff machine, like the Olsen type, has separate fulcrums for static and dynamic balancing. In the case of the Akimoff machine, the whole machine except the base plate, rocks when determining the static unbalance. The vertical frame is mounted on a spring

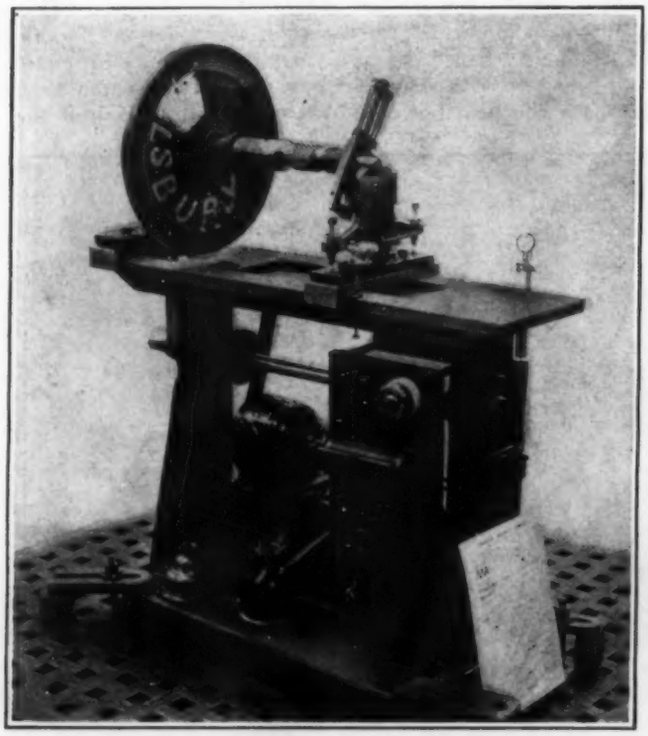


Fig. 7—Balancing a turbine wheel on the Akimoff machine

Fig. 8—The arrangement of the Davey "Vibroscope" for balancing

steel support. The frame can be locked in position.

On the table of the machine are two vertical standards. The one to the left is stationary while the one to the right can be unlocked to rock in the same manner as the frame unit. Upon the shaft of the object to be balanced is placed a clamp which can be seen to the right. This clamp can be set at any angle and it carries a weight which can be adjusted to any radius so as to counterbalance the unbalance of the object. The object is first corrected for static unbalance and then a second operation is used to correct the dynamic unbalance.

Another and entirely different principle is involved in the case of the Davey "Vibroscope" marketed by Vibroscope, Inc., 11 Broadway, New York, N. Y. Fig. 8 shows the apparatus as used in the balancing of the motor armature of a cloth cutting machine. The principle of operation involves that of the stroboscope and a light flashing on the object being balanced, at regular intervals of once or twice per revolution, will make the revolving body appear to stand still. The Vibroscope unit has an interruptor handpiece which is shown to the right attached to the armature shaft of the cutting machine by means of a rubber hose coupling. It is driven from the motor of the cutting machine in this instance. The rotation of the interrupter flashes the special Vibroscope lamp which is shielded beneath the black reflector at the center of the table. Each segment of the armature is numbered and the shaft will appear to be slowly turning as the housing of the interrupter is revolved by hand.

The Vibrometer shown at the left, contains an arm that is held against the vibrating part and transmits the vibration to an illuminated indicator that can be observed beneath a lens. When the Vibrometer is used alone, the hairline on the vibrating arm will appear as a blur, the extent of which can be observed against a scale that is graduated to show the amplitude of vibration in thousandths of an inch. In connection with the Vibroscope, the hairline on the vibrating arm can be made to appear as a double image of which the distance apart of the two lines indicates the amplitude of the vibration. This is accomplished by pulling out the housing of the interrupter to its outer position, thus doubling the number of flashes per revolution. When the interrupter is pushed in again, one of the lines will disappear. The one which remains will be the one toward the heavy side of the armature shaft. The amount of correction necessary for obtaining proper balance depends on the severity of the vibration.

Press Work a Factor in Production on Screw Machines

Next to screw machines, the hand, foot and power presses comprise the most important group in the production lines, according to a recent count in the division

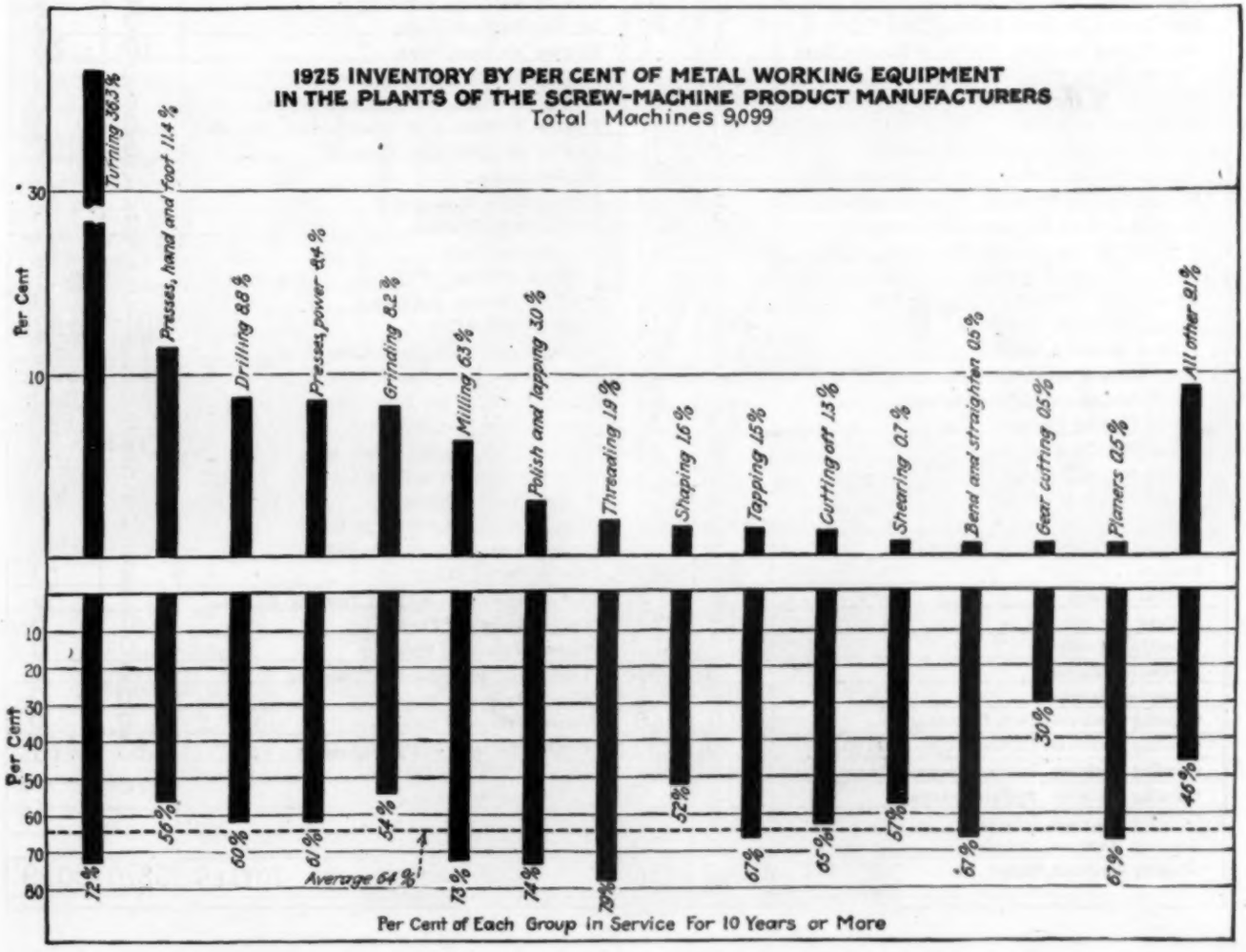
THERE are approximately 9,100 metal-working machines of all types in the screw-machine product division of the metal-working field. Attendant on these machines is a total of approximately 9,000 workers in those plants which employ six or more men.

Two points are worthy of attention in this division. One is the serious age handicap under which profitable operation must be conducted. The study showed that the screw-machine group (turning) contains 72 per cent of equipment that is 10 years old or older, a seriously high average. The second point is the unexpectedly large number of presses, of three types, foot actuated, hand actuated and power driven. Of the total machines, approximately 20 per cent is in this group.

The average for the next four groups of equipment, hand and foot presses, drilling machines, power presses, and grinding machines, is 58 per cent. The number of machines in these four groups, however, is only about equal to that of the single group of turning of which 72 per cent is old equipment. About 73 per cent of the milling machines are at least ten years old and 79 per cent of the milling machines have seen ten years of service.

The counts are the result of a questionnaire sent out by the *American Machinist*. The study itself is one of a number being made in various divisions of the field.

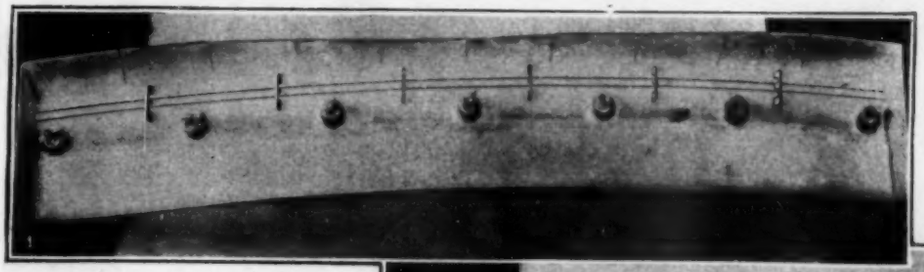
Following the same outline that has held in previous studies, the divisions by operation and group ages, are given in the chart below. On the following page the questionnaire is reproduced to show the detailed count.



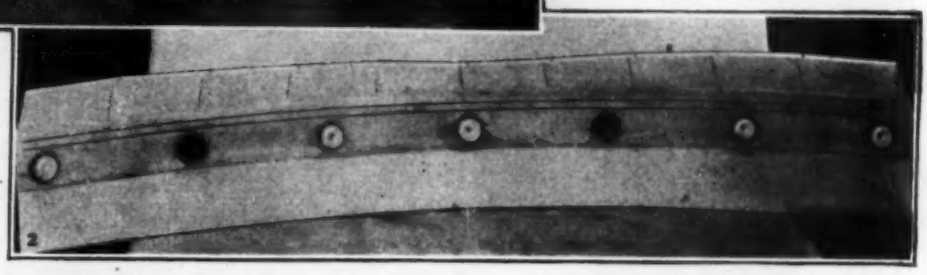
METAL WORKING MACHINES IN THE SCREW-MACHINE PRODUCTS PLANTS

Kind of Machine Tool	A Number Built Before 1918	B Total Number in Plants 1925	Kind of Machine Tool	A Number Built Before 1918	B Total Number in Plants 1925
Engine Lathes	132	238	Grinding Machines, Floor, No Feed Attachments	116	228
Hand Turret Lathes	0	0	Grinding Machines, Bench, No Feed Attachments	167	253
Power Turret Lathes	15	25	Grinding Machines, Disk	20	40
Semi-Automatic Lathes	0	0	Grinding Machines, Belt	0	5
Hand Screw Machines	221	288	Grinding Machines, Centerless	10	25
Automatic Screw Machines, Single Spindle	1123	1481	Polishing and Buffing Machines, Wheel	187	253
Automatic Screw Machines, Multiple Spindle	492	643	Polishing and Buffing Machines, Belt	5	5
Chucking Lathes	10	10	Polishing and Buffing Machines, Semi-Automatic	10	15
Multiple Spindle Chucking Machines, Rotary Work	50	51	Lapping Machines	0	0
Multiple Spindle Chucking Machines, Rotary Tools	0	0	Honing Machines	0	0
Speed Lathes	111	142	Cutting-Off Machines, Parting Tool Type	0	0
Bench Lathes	46	182	Cutting-Off Machines, Power Hack Saw Type	61	101
Tool Room Lathes	177	243	Cutting-Off Machines, Rotary Cold Saw Type	10	10
Wheel Lathes	0	0	Cutting-Off Machines, Band Saw Type	5	5
Axle Lathes	0	0	Cutting-Off Machines, Friction or Hot Saw	0	0
Forge Lathes	0	0	Shears, Knife	15	25
Hand Milling Machines	152	212	Shears, Rotary	0	0
Bench Milling Machines	20	51	Shears, Slitting	20	35
Plain (Knee and Column Type) Milling Machines	157	162	Nibbling Machines	0	15
Universal (Knee and Column Type) Mill. Mach.	46	91	Hammers, Steam	0	5
Vertical (Knee and Column Type) Mill. Mach.	15	15	Hammers, Pneumatic (not portable)	0	0
Lincoln Type Manufacturing Milling Machines	0	0	Hammers, Drop	5	10
Semi-Automatic Type Milling Machines	0	10	Hammers, Helve	5	6
Continuous Mill. Mach. Rotary or Drum Type	25	30	Hammers, Spring	5	5
Planer Type Milling Machines	0	0	Riveting Machines, Pneumatic	0	0
Gear Cutting Machines, Rotary or Milling Type	10	30	Riveting Machines, Hydraulic	0	0
Gear Cutting Machines, Hobbing Type	5	20	Riveting Machines, Steam	0	0
Gear Cutting Machines, Planing or Shaping Type	0	0	Riveting Machines, Power	10	26
Vertical Boring Mills	5	10	Forging Machines, Hot, Bulldozers	0	0
Horizontal Boring Machines	10	20	Forging Machines, Hot, Forging Machines	0	0
Radial Drilling Machines	25	51	Forging Machines, Cold Headers, Bolt, Nut, etc.	0	5
Upright Drilling Machines, One Spindle	101	152	Forging Machines, Cold, Swaging	0	0
Upright Drilling Machines, Two or More Spindles	10	40	Bending Brakes	0	0
Upright Drilling Machines, Two or More Heads	5	10	Bending Rolls, Horizontal	20	31
Sensitive Drilling Machines, One Spindle	233	400	Bending Rolls, Vertical	0	0
Sensitive Drilling Machines, Two or More Spindles	106	147	Straightening Rolls	14	20
Sensitive Drilling Machines, Two or More Heads	0	0	Punching Machines	10	11
Two-, Three- and Four-way Drilling Machines	0	0	Combined Punches and Shears	0	0
Tapping Machines, Single	91	126	Presses, Hand, Arbor	101	142
Tapping Machines, Multiple	0	10	Presses, Hand, Light Punch Press Work	25	46
Pipe Threading and Cutting Machines	5	10	Presses, Foot, Light Punch Press Work	458	851
Bolt Threading and Cutting Machines	25	30	Presses, Power, Crank Type	410	623
Thread Chasing Machines	30	31	Presses, Power, Toggle Type	5	20
Thread Hobbing Machines	0	0	Presses, Power, Double-Acting Type	5	24
Thread Milling Machines	0	0	Presses, Power, Dieing Type	0	0
Thread Rolling Machines	76	101	Presses, Power Automatic	36	66
Planers	25	40	Presses, Power, Trimming Presses	0	0
Open-side Planers	5	5	Presses, Power, Forcing, Arbor, Wheel	5	6
Shapers	76	142	Presses, Power, Baling	9	10
Vertical Shapers	0	5	Presses, Hydraulic, Bending, Forming, Drawing	5	5
Slotters	15	21	Presses, Hydraulic, Forging	0	0
Broaching Machines	20	21	Presses, Hydraulic, Flanging	0	0
Keyseating Machines	5	6	Presses, Hydraulic, Forcing, Wheel, etc.	0	0
Centering Machines	4	5	Presses, Hydraulic, Baling	0	0
Grinding Machines, Plain Cylindrical	30	40	Presses, Hydraulic, Extruding	0	0
Grinding Machines, Universal Cylindrical	20	35	All other machines and miscellaneous	283	667
Grinding Machines, Surface, Reciprocating	15	56			
Grinding Machines, Surface Rotating	5	5			
Grinding Machines, Internal	4	5			
Grinding Machines, Cylinder	0	0			
Grinding Machines, Cutter	30	56	TOTALS	5820	9099

Automotive Production



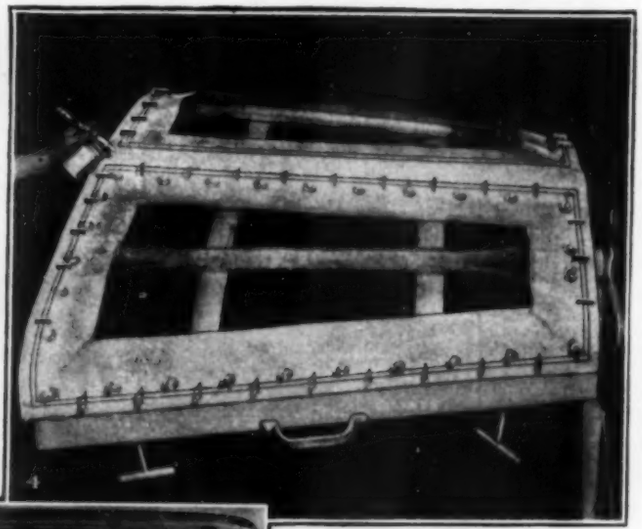
1—A stencil for double stripes. It is made of thin tin plate and is held in place by vacuum cups. The strip between the stripes is held in position by bridges



2—Underside of the stencil, showing the vacuum cups by which it is held in place. The vacuum cups do not mar the body finish

Striping Automobile Bodies With an Air Brush

3—Striping the top of the cowl. The sides have been striped previously by the use of another stencil. By tilting the vacuum cups air is admitted, allowing easy removal of the stencil



4—A stencil for the top of the hood. It is braced by shallow channels. Note the large number of vacuum cups necessary to hold it in position

5—Method of applying the stencil to the sides of the body. Striping by stencils and the air brush has proved satisfactory

Photographs by courtesy of the H. H. Franklin Manufacturing Co.

Automotive Production

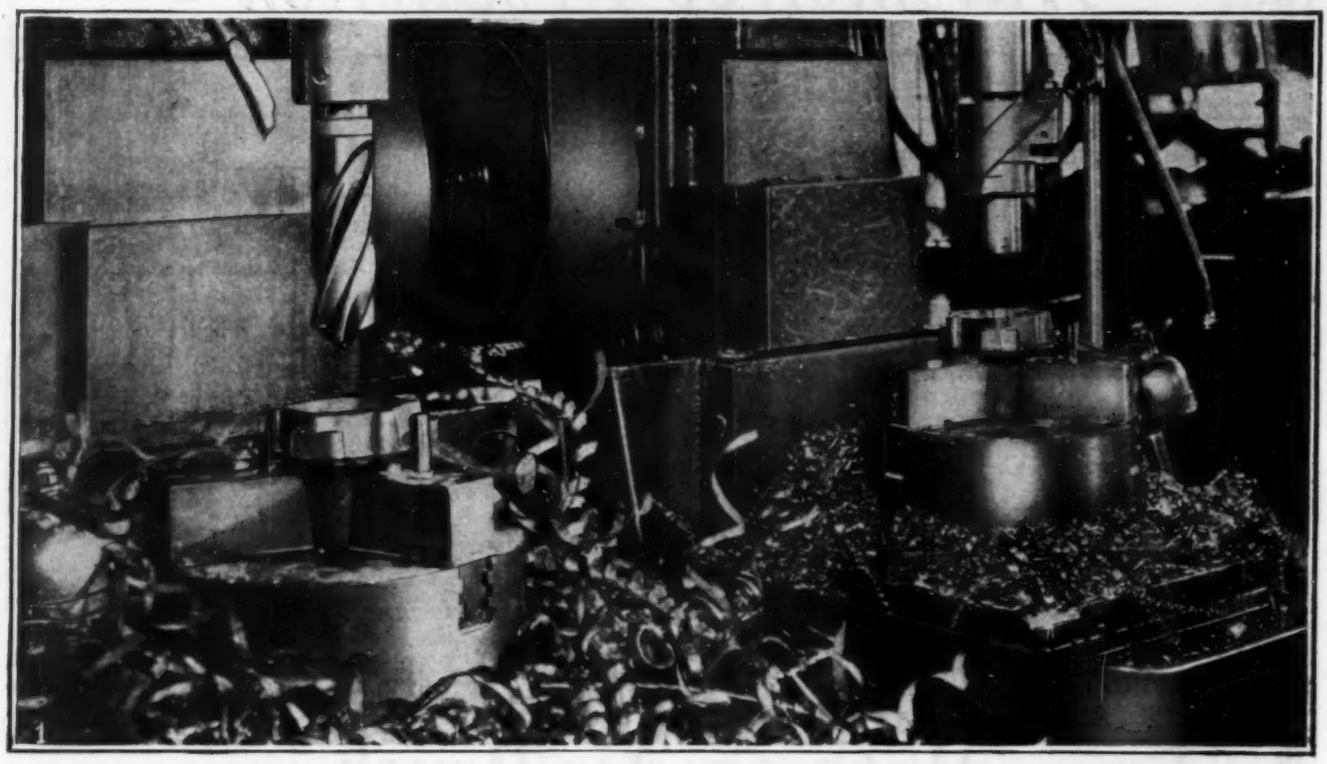
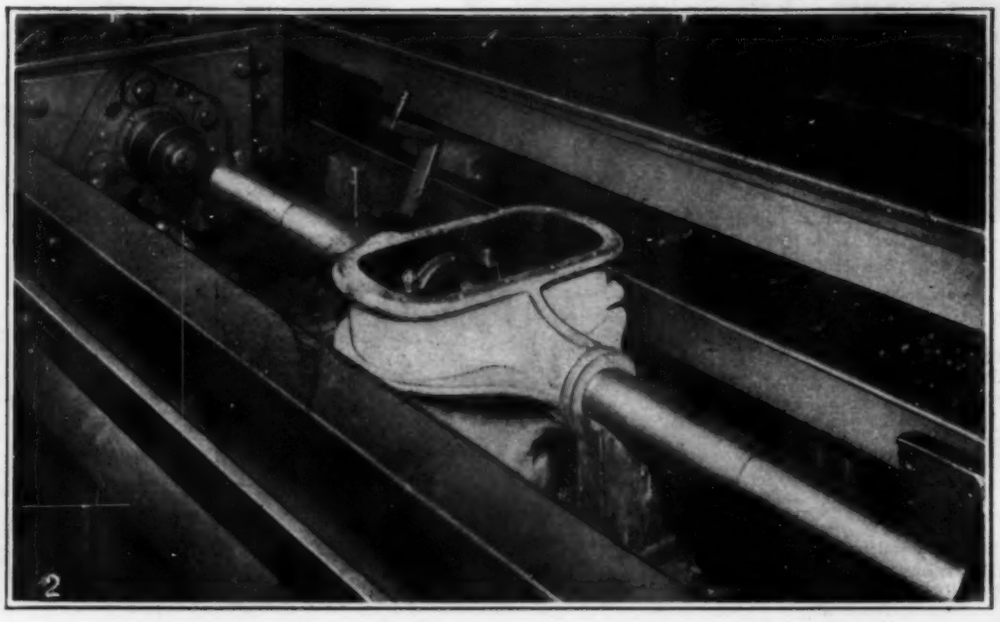


Fig. 1—Machining the brake hanger brackets. Drilling at left, reaming and facing at right

Assembling and Testing
Franklin Axles

Fig. 2—Axle tubes are forced into the housing by hydraulic pressure



Automotive Production

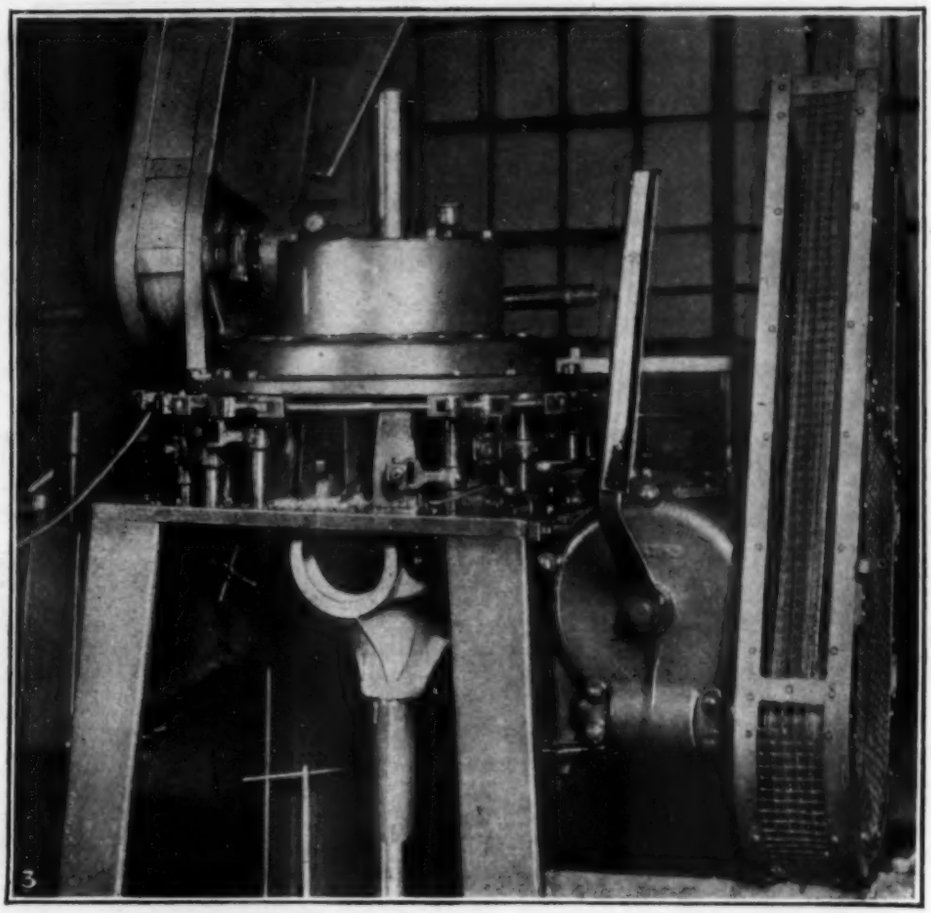


Fig. 3—A special machine for drilling the rivet holes in half the rear axle housing and the tube. The axle is easily put in place and clamped, and the drills fed radially into the work by means of the toggles shown. After one end is drilled the axle is turned end for end and the operation repeated. Production is high

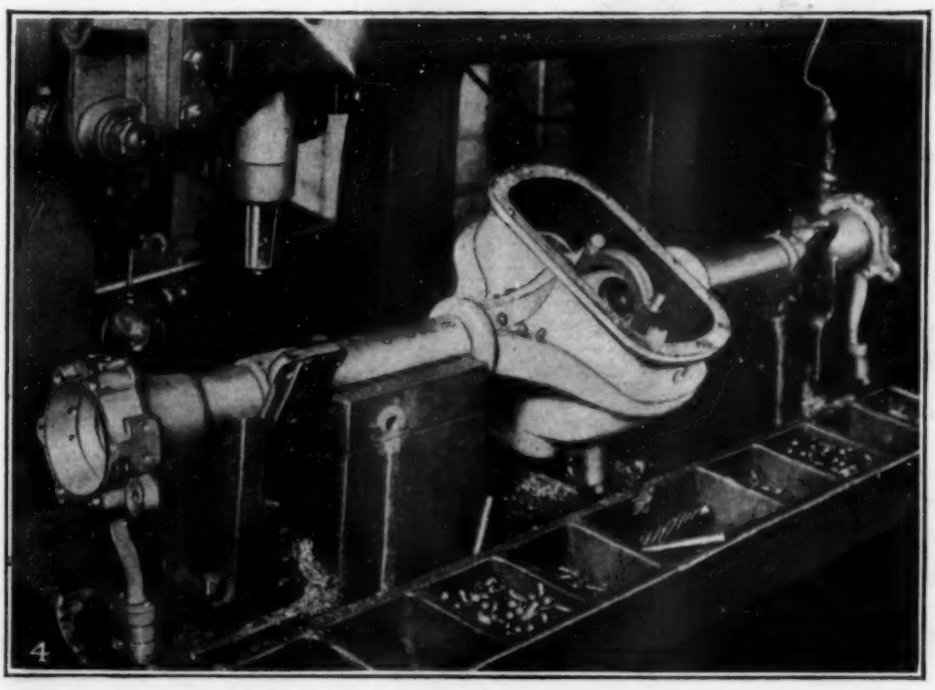


Fig. 4—After riveting the differential housing in place, the axle goes to the riveting machine shown where the spring pads and brake hangers are applied. These are all riveted solidly in place ready for assembly. Much time is saved by having the rivets conveniently placed in the tray shown in front

Automotive Production

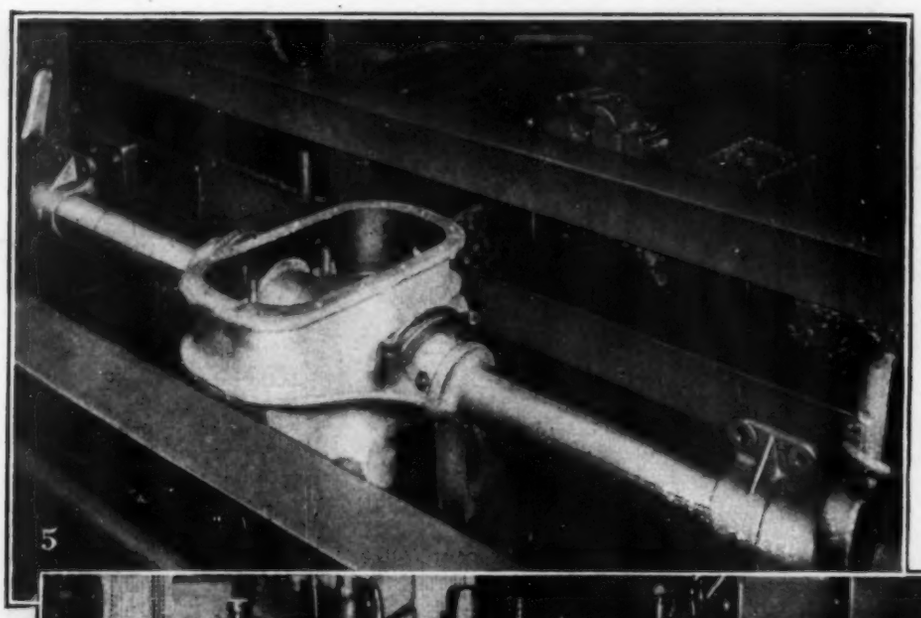


Fig. 5—Stand for assembling the differential housing. Here again the parts to be used in assembling are placed very conveniently for the operator. One of the differential bearing caps is shown outside the housing at right

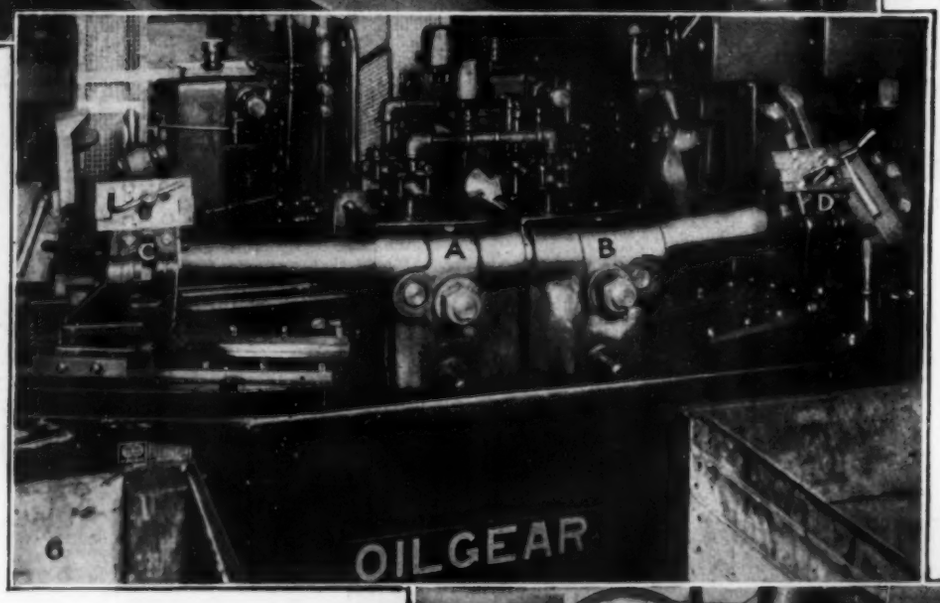


Fig. 6—Special oilgear press for assembling spring pads and parts on to bottom front axle. Hydraulically operated clamps *A* and *B* hold the axle in the center while parts held in heads *C* and *D* are forced on to the tube. The method is rapid, positive and accurate in operation

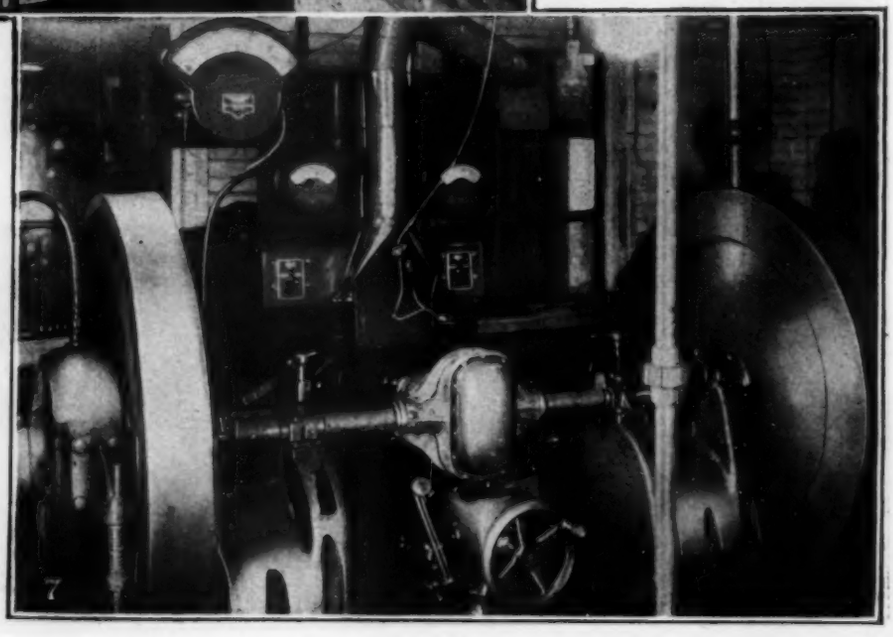


Fig. 7—Testing stand for complete rear axle assembly. Heavy flywheels provided with brakes permit any desired load to be applied, so as to test for noise both under load and with car driving the gears. Telephone and loud speaker amplification help to detect noise. The test stand is in a silent room

Manufacturing Tools to Make Safety Razor Blades

By Ellsworth Sheldon
New England Editor, American Machinist

How the blanking die is made—Oil-hardening steel used—Openings in the dies are broached—Size and shape are maintained by standard gages

THE sequence of operations followed in making the dies to blank Gillette safety razor blades is shown by the operation sheet, Fig. 12. As in the case of the other parts, fifty or more dies are made up at one time and go into stock. Jigs and fixtures are provided for each operation that involves accurate machining.

The dies are made of a non-shrinking, oil-hardening steel that experience with this work has shown to be justly entitled to that designation, in that the dies do not change their shape appreciably in undergoing the heat-treating operation. The dies are virtually finished before they go to the hardening room, there remaining only to lap the openings to fit gage plugs, to grind the flange and to drill and ream the dowel holes in the flanges. Stock for the dies is cut off by a cold-saw from a 2¾-in. round bar of steel, and the blank is first gripped in a standard four-jawed lathe chuck to rough turn the body. It is necessary to hold the size closely for the reason that the next operation involves gripping the piece in a ring chuck by the newly-turned diameter while the portion previously covered by the chuck jaws is turned and faced to the prescribed dimensions of the flange.

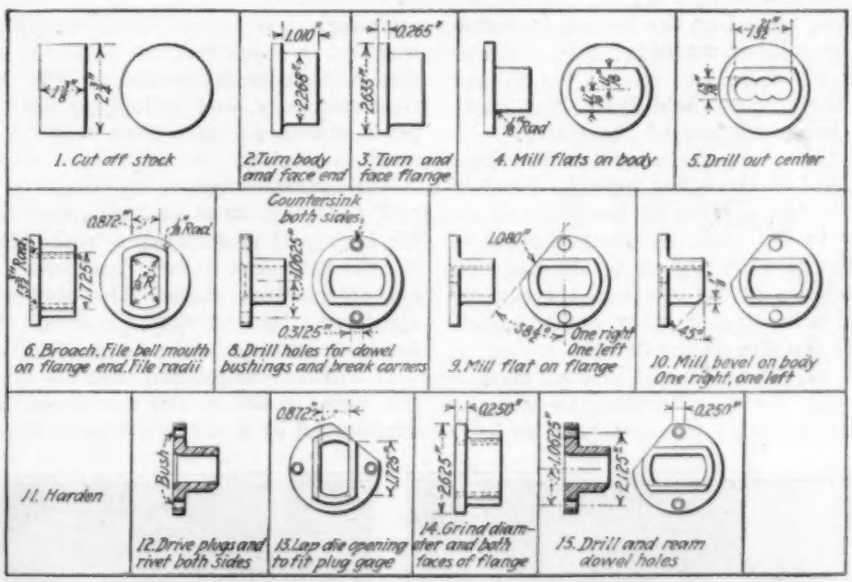

1. Cut off stock
2. Turn body and face end
3. Turn and face flange
4. Mill flats on body
5. Drill out center
6. Broach. File bell mouth on flange end. File radii
Countersink both sides
8. Drill holes for dowel bushings and break corners
9. Mill flat on flange
One right
One left
10. Mill bevel on body
One right, one left
11. Harden
Bush
12. Drive plugs and rivet both sides
13. Lap die opening to fit plug gage
14. Grind diameter and both faces of flange
15. Drill and ream dowel holes

Fig. 12—Operation sheet for the blanking die.

Operation 4 is to flat the sides of the body; a job that is performed upon several pieces at one setting, by a pair of straddle mills that cut both sides of the row of blanks at once. This fixture, to be seen in Fig. 13, is used in a standard milling machine. The base of the fixture is a rectangular plate, located on the table of the milling machine by a rib on the under side fitting the middle slot of the machine table, and having in its upper surface a row of shallow counterbored recesses of a size and depth to receive the flanges of the die-blanks.

The blanks are held in the recesses by short straps between adjacent pieces, secured by hexagon-head cap-screws. A block of hardened steel is let into the cast-iron plate at one end, and in line with the row of die-blanks, to serve as a setting gage for the cutters, so that the cut may be divided equally between the sides of the blanks. One pass of the cutters over the row of blanks completes the job. The stock is removed from the centers of the die-blanks by drilling, and for this work the tools to be seen in Fig. 14 are used. The jig here shown is fitted with a slip bushing so that a small pilot hole may be drilled through the center of the blank between two larger holes, and then without disturbing the set-up the slip bushing is removed and the larger drill is put through to follow the pilot. This drill breaks out both sides into the previously drilled holes, and leaves an opening shaped as in stage 5 of the operation sheet.

The dies go next to the broaching machine shown by Fig. 15, where four broaches are pulled through the drilled opening successively to finish it accurately to size and shape. The shape of the opening left by the

The third and concluding article.

drills is irregular, but an average of about 1/8 in. of metal is left to be removed by the broaches. The sizes and shapes of the broaches must be maintained to within 0.0001 in., and it is very essential that they should leave no scratches or imperfections in the broached surface at any part of the opening.

In first turning the blank, stage 3 of the operation sheet, the body is left 0.018 in. oversize, so that after the die has been broached it may be pushed on a plug arbor made to fit the broached hole, and is reduced to finished diameter. This compensates for any possible slight drift of the broaches and assures the symmetry of the die.

The next operation is to drill the holes in the flange of the die for the dowels that are to locate it in the sub-press. As in the case of the blanking punch, these holes are of vital importance to the matching of the tools, since they are the locating points with reference to the flat sides of the die-opening. The holes are jig-drilled at this stage, considerably larger in diameter than the dowels that are to fit them, and are countersunk on both sides of the flange. After the die has been hardened, these holes are filled with soft steel plugs, riveted in place, and the actual dowel holes are drilled in the plugs at a later stage.

There are two full sets of dies and punches in each sub-press, and their relative positions therein are so close together that the flanges would interfere if provision was not made against such interference, hence the dies go next to the fixture shown by Fig. 16 to have a part of the flange milled away.

This fixture, like that shown by Fig. 13, is a rectangular plate of cast iron, ribbed on the bottom to match the middle slot of the milling machine table. Instead of locating by means of recesses to receive the flanges of the die, however, the dies are held upon short studs projecting from the upper surface of the plate.

The studs are of the same shape as the broached openings of the dies and fit the latter tightly. Shallow slots are milled across the surface of the plate at an angle complementary to the angle at which the cut is to be made on the flange with respect to the flat side of the die. The flat sides of the studs fit these slots, to fix their position relative to each other, and to assure the correct location of the dies on the fixture.

A small projection at the upper end of each stud is threaded and fitted with a nut and washer to hold the die firmly against the action of the cutter. The location of the rows of studs with respect to each other is such that the passage of a side-milling cutter of suitable width down the length of the fixture between the two rows of dies, mills off a portion of the flange of each die, and also a small part of the body where the latter would interfere.

The die nearest the observer in Fig. 16 has been removed (after the cut has been made) to show the stud and the method of locating its angular position. The effect of the operation may be seen more plainly in stage 9 of the operation sheet. From this point onward the dies are "rights" and "lefts" with reference to their positions in the sub-press, though their relation to the blanking and piercing punches, shedders, etc., is not affected.

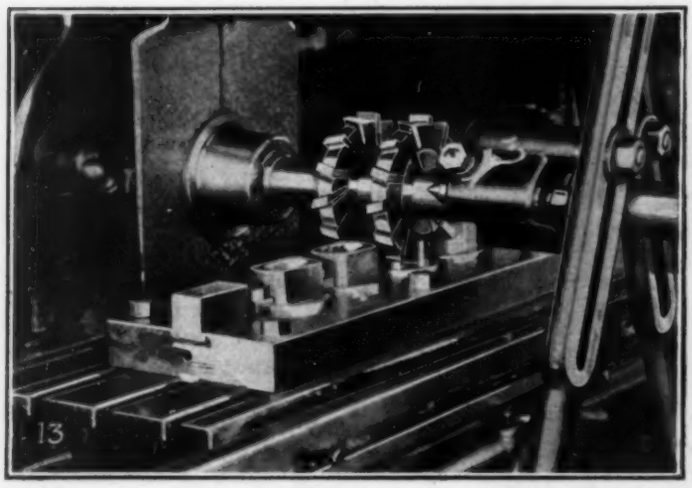
Though the bodies of the dies when in the sub-press do not have to fit anything but the surrounding air, it is very desirable for the sake of those who have to handle the tools in the making to break the sharp corners. The operation sheet calls for a radius of 1/8 in., but it is not arbitrary. The work is done by hand filing. There is no specific place in the sequence for this operation. The corners are brought into existence by the milling cut of stage 4, and the sooner thereafter they are broken, the better it will be for all concerned.

An operation that is of more importance to the tools themselves is the bell-mouthing, or rounding, of the back corners of the die-opening to clear a fillet on the shedder where the body of the latter joints the flange. When in service the shedder fits into the die-opening from the back and the flange bears upon the bottom of the die.

Though the operation of rounding this corner is specified in stage 6 of the sheet, as filing, it is actually done with a profiling cutter. The object of the cut is clearance, only, and so long as non-interference of the parts is assured there is no need for accurate measurement or gaging.

The operation shown by stage 10 of the sheet is to mill a 45-deg. bevel on the upper front corner of the die body. It is done on a hand milling machine with the die held on a fixture from which a stud projects at a corresponding angle. The dies must be handled as rights and lefts in this operation. To find the reason for the operation we must go back to the sub-press.

It will be remembered that the blanking punches are the lower tools in the sub-press, and that they are surrounded by a spring-actuated stripper to which they



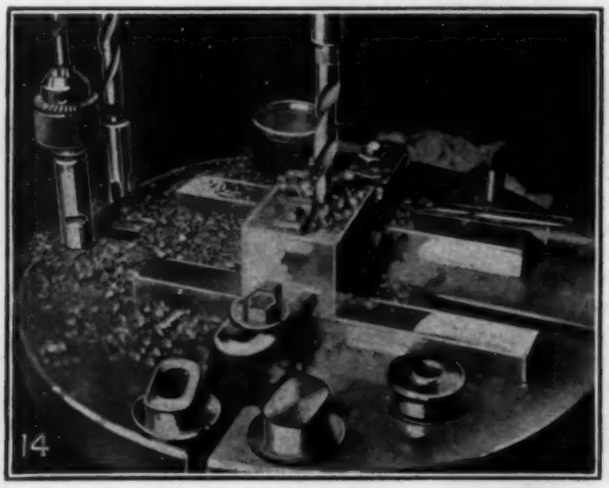
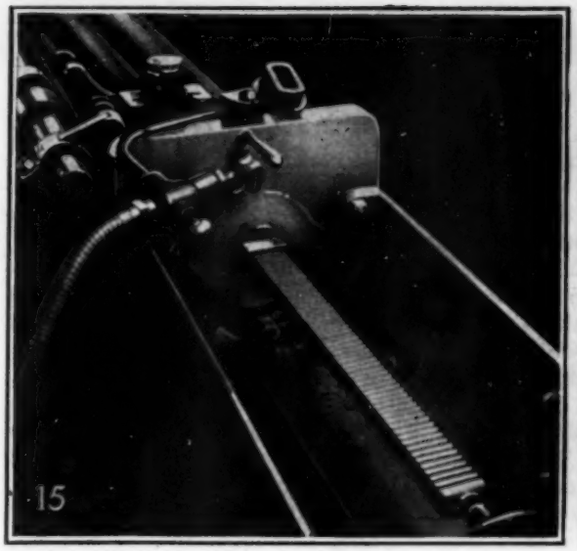


Fig. 13—Milling the flat sides of the dies. *Fig. 14—Drilling out the centers*



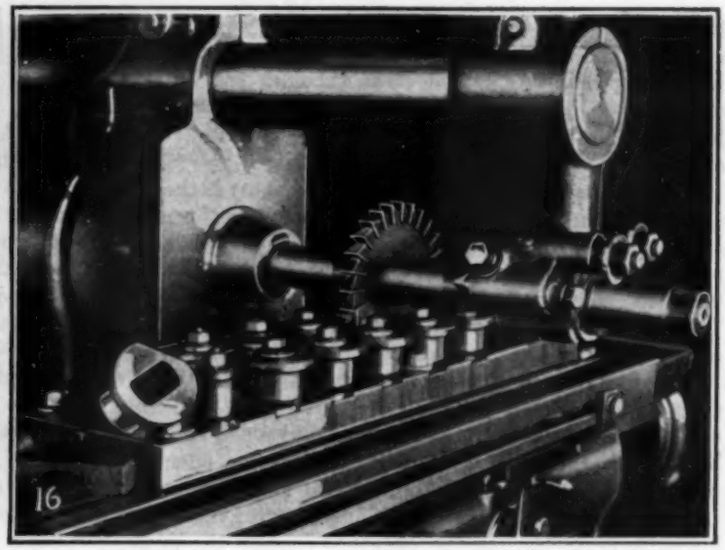


Fig. 15—Broaching the die-opening. Fig. 16—Milling off the interfering flanges

are closely fitted, so that the surface over which the stock passes when the press is in action, is smooth and to all appearances unbroken.

This condition does not obtain with respect to the upper tools. The unprotected die projects from the plunger and if the front corner were left square it would be continually catching the end of a strip of stock each time the operator started a new strip in the dies, to his great annoyance and loss of time. The space to which he has to introduce the 0.006 in. stock, it will be remembered, is but 0.010 in. at the most.

Cutting the bevel on the front corner of the die is the last machining operation before the die is hardened. Each time they are reground, however, this beveled corner must be carried back a corresponding amount, and this result is accomplished very expeditiously and easily by the operator whose job it is to disassemble the tools for regrinding and to put them together again after they are ground.

One item of the equipment of his bench—to be seen in Fig. 17, though the motor to be described is not in sight—is an electric motor of a size small enough to be grasped conveniently in one hand, and upon its rotor shaft is a grinding wheel of corresponding size.

Suspended from its flexible conductor, this little grinding outfit is as handy as a file, and it has a distinct advantage over the file in that the wheel is potent against hardened steel. A few strokes of the wheel across the beveled corner of the die not only carries the bevel back to correspond with the new level of the reground die, but it rounds and polishes the corner at the same time so that it cannot possibly catch on the edge of an advancing strip of stock.

The only treatment accorded to the dies in the hardening room that is at all out of the ordinary, is to cover the flanges to protect them from the fire. A cement, made principally of asbestos, is molded around them and remains until the die is quenched.

The dies are heated in a muffle furnace and quenched in oil. The asbestos covering comes off, of course, when the hot die is plunged into the oil, but it has served its purpose of protecting the flange, so that the latter is not so hard as it would otherwise be, though it is not entirely soft.

When the dies come from the hardening room, the next operation is to drive plugs of soft steel into the $\frac{1}{8}$-in. holes in the flange and rivet them over at both ends so that the plugs become virtually a part of the flange. This is stage 12 of the operation sheet.

The lapping, shown by Fig. 18, is done with small pencil-shaped laps, of soft metal, charged with a special abrasive compound and driven at a high rotative speed

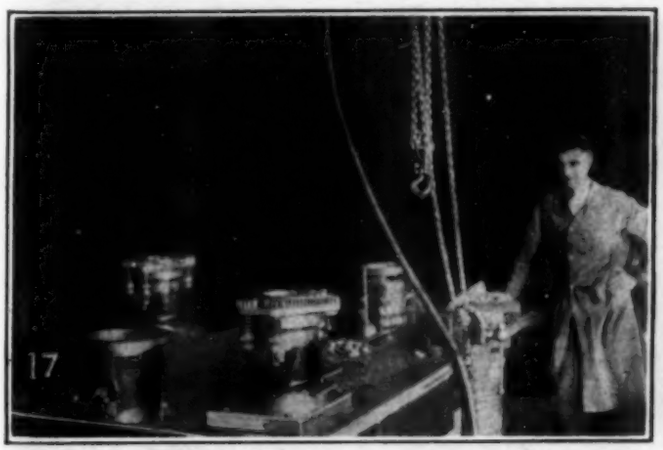


Fig. 17—Bench where sub-presses are disassembled to grind the tools. Fig. 18—Lapping the die-opening to the plug gage

by an electric motor to which they are connected by means of a flexible shaft. Three plugs of successively increasing size are passed clear through the die. One of the plugs, with a handle screwed into it for convenience of handling, may be seen in Fig. 18 near the operator's hand.

The cross-section of each plug is, of course, the same as that of the product of the dies except in the matter of size. Each plug is of two sizes—like a go-and no-go plug gage—with the pilot portion of the first plug 0.001 in. smaller than the body over both dimensions. The pilot will usually fit without hesitation into the opening of the hardened die.

The operator covers the first plug lightly with an oil color and pushes it into the die. The pilot will enter, and the body size may follow. In any case there will be some of the color left on the wall of the opening to indicate to the operator where metal is to be removed.

After taking down the obvious bearing spots with his little revolving lap the operator repeats the process, alternately testing with the plug and lapping out the high spots until all of the plugs have been through the die. The pilot of the second plug is of the same size as the body of the first, the same condition applying to the second and third plugs except that the increment is less.

After the final plug has passed through, the die is pushed on a closely fitting plug arbor, on which it is retained by a nut and washer, and is ground upon the flange to diameter. At the same setting the bottom of the die is faced off with the wheel, and the narrow shoulder opposite is also ground, so that both sides of the flange are parallel.

The die sets in a recess in the lower end of the plunger of the sub-press and is located therein with reference to the other tools by the dowels fitting in

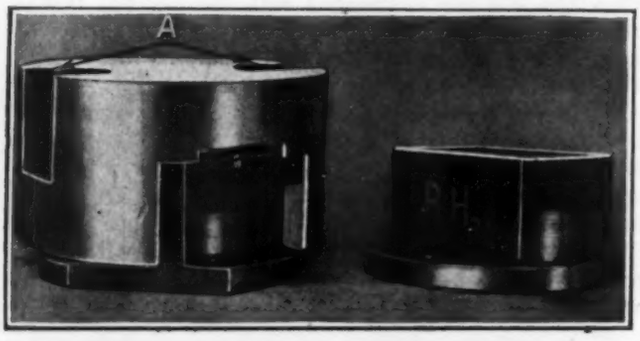


Fig. 19—Locating the dowel holes in the flange; the final operation

the holes of the flange. These holes, which are the ones that have been plugged with soft steel, are now drilled and reamed, this being the last operation upon the die before it goes into the sub-press.

The jig shown in Fig. 19 is used to locate these holes. A stud, projecting downward from the under face of the jig, fits tightly in the die opening and brings the drill bushings at *AA* over the soft steel plugs. The jig does not necessarily touch the die at any point other than the plug, though it may rest upon the flange without prejudice to the location of the holes.

The productivity of the United States has increased twice as fast as its population. In other words, with an increase of population of 16 per cent, the productivity of the country has increased about 32 per cent.

Training the Foremen

By Entropy

I WAS lunching with Jim the other day when a friend of his came along. His name is, or might be, Smith. He is works manager of a shop of about 2,000 hands, and the business has grown up from a shoestring. Recently Smith has taken in some outside capital, which appears to have taken him over body and soul. In the course of the conversation it developed that these capitalists are pressing him hard to bring the business up-to-date. Smith is worrying for fear that if he does not make changes they will change works managers, and if he does make radical changes they will lose money. As he puts it, "I am between the Devil and the deep sea. These chaps have been looking over the shop and they don't like the looks of my foremen. They want me to fire the lot. I know that if I fire them I will have a hard time training new men, and we will lose money for months. If I fire them I don't know where they are going to get jobs. I really wish I had been content to keep the business growing slowly out of its profits instead of getting this gang of high production men on my back."

We admitted that he had put himself into a tough situation, and that he would have to be a real genius to about face and not have anyone catch on to what he was doing. We finally advised him as follows:

"You do not realize that you have stood between your foremen and progress, and that they have not seen changes as you have. Your foremen believe that they are foremen because they were good workmen. You made them foremen because they were good executives, but ask them if they are managers and they will laugh at you. Yet if they could not manage their men and their work you would not have them as foremen.

"They think that it is their job to get work done as quickly as possible, yet very likely they have no way of knowing how quickly any job can be done. They probably have no idea of what enters into costs. They do not realize that it is cheaper for you to have some men spend all of their time doing work that is charged to overhead, than to have them doing some work that can be charged to jobs.

"Their idea of planning work is to have plenty going through the shop so that there will be an abundance of jobs from which to pick one suited to the next man who gets through. Their idea of efficiency is to let each workman finish his job, and then come to the forman and discuss what might be a good job to do next.

"Now Mr. Smith, we have not painted the picture one bit blacker than it is in your shop and hundreds of others that are paying dividends. Your new backers are not satisfied with the half returns that you have been getting. You could have doubled your profits if you had made your foremen see the difference between being an expert mechanic and being an executive.

"What you can do is to launch a campaign to get the foremen to see what they should do as executives. A few talks with your foremen will set them to thinking in a very different way, and you will begin to get suggestions, which if followed up will find your foremen asking you to let them do just what your backers want. Remember that a foreman is not in a position to get out, as you can, and see the world go round, but that he has to stick to his knitting every day."

Applying Electrical Equipment to Production Machinery

By Robert Corey Deale
Electrical Engineer, Niles-Bement-Pond Co.

Characteristics of dynamic-braking and plugging types of controllers for reversing planer motors—Motor-generator type of planer drive with two forms of control—Electric feed and clamping

DIRECT-CURRENT controllers for reversing motor planers are highly developed to secure the maximum of reliability. They may be divided into the dynamic-braking and the plugging types of control. Dynamic-braking controllers are those in which the motor is brought to a stop by dynamic braking before the reversing contactor is allowed to close. In this way the starting up of the motor is the same in effect as starting it up from rest. Plugging controllers do not use dynamic braking during their automatic operation at all; the motor is reversed by immediately reversing the voltage applied to the armature. Reversal is very rapid, but it is necessary to use extra armature resistance, and particular care is required to make certain that sufficient armature resistance is in circuit when the motor is reversed and that it is not short-circuited too rapidly. Usually dynamic-braking controllers for planers are so built that dynamic braking is used to decelerate the motor to a low speed and then plugging is used to complete the reversal. Such a controller can be built without much extra complication and it is little, if any slower in operation than one of the plugging type, while less severe on the motor.

In the dynamic-braking type of controller, of which the controller shown in Fig. 96 is a very late example, the motor is brought up to speed in the usual way, with one or two contactors to cut out the starting resistor and cut in the field rheostat. In addition, there is usually a contactor or circuit breaker, with or without supplemental relays, to provide overload and low-voltage protection and to bring the planer motor to a stop in case the breaker opens for any reason. This safety feature is very valuable, as, without it, the planer table would coast to a stop. In this event the table might run off the bed; or the work run into a tool, a head, or the cross-rail, with chances of serious accident. The controller shown in Fig. 96 has all these features. Neither of the plugging controllers, of which that shown in Fig. 97 is typical, has this feature, although both have overload and low-voltage protection. To overcome this difficulty, the motor fields are connected to the line back of the circuit breaker, so that they are always energized. This method helps somewhat, but is of no use when the voltage fails or the circuit is opened between the controller

Fig. 96—Dynamic-braking controller for reversing planer motor
Fig. 97—Plugging-type controller

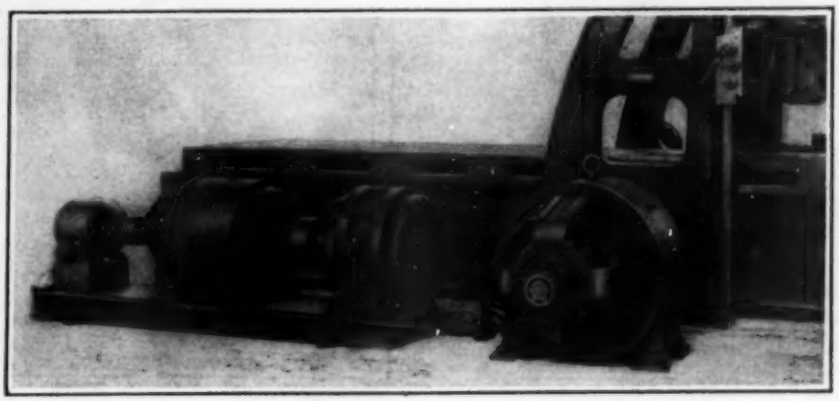
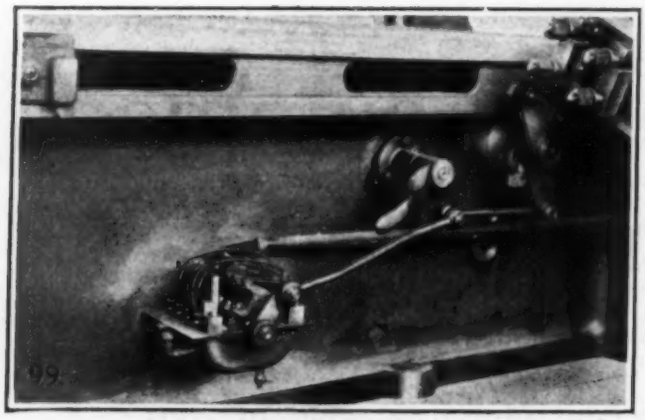


Fig. 98—Planer motor reversed by motor-generator set

The twelfth article. The thirteenth will appear in an early issue.



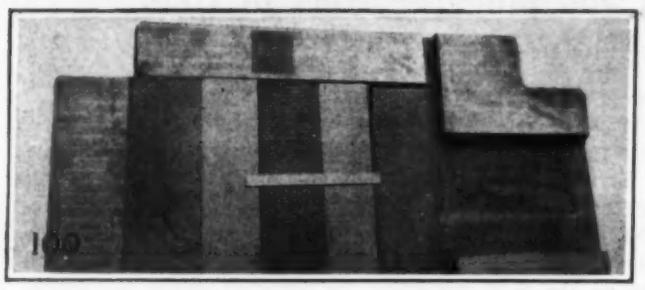


Fig. 99—Mechanically-operated reversing switch for motor set shown in Fig. 98. Fig. 100—Accurate tool travel obtained with reversing motor drive

and the generator in the power house by some chance.

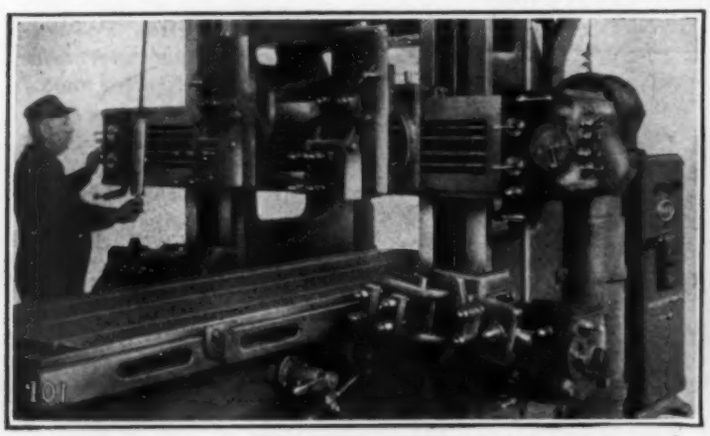
The plugging controller is much more elaborate than a dynamic-braking planer controller. Usually it consists of two controllers mounted on one panel to insure that the motor will not reverse without resistance in the armature circuit. In addition, as it is usually built, although this is not inherently necessary, there is a multiplicity of auxiliary contacts and consequently a greater possibility of trouble.

Dynamic-braking controllers need only two reversing contactors and one or two accelerating contactors. The usual practice is to cut out the starting resistance in one step. This procedure is very satisfactory for motors up to 50 hp., but it is believed advisable to use two steps on motors ranging from 60 to 100 hp. in order to secure smoother reversal.

With the dynamic-braking type of controller, in case of breakage of a control wire or failure of a control circuit for any reason, the motor automatically comes to a stop. If double-pole line contactors are used, the attempt to reverse the motor while a line contactor is frozen in the closed position short-circuits the line, thus tripping the circuit breaker and bringing the motor to a stop. Plugging controllers have an extra dynamic-braking contactor which is used only when the motor is stopped by the push-button pendent switch.

The automatic controller for a planer is usually actuated from two places: the first, a switch thrown (through a system of levers) by movable dogs on the planer table; and the second, a manually-operated switch, usually hanging from a flexible cable so as to be in a convenient location for the operator. The automatically-operated switches, while different in construction, are substantially the same in operation. It is in the pendent switch where the greatest variation occurs. There are three types. The first of these has a simple two-button push button as a pendent switch, with a supplemental switch which must be operated to transfer control from the pilot, or automatically-operated switch to the pendent switch, and vice versa. The second is a push-button station having a multiplicity of buttons, usually five, which combines pendent and transfer switches. This is better, although the five-button station makes a somewhat clumsy switch, and one difficult to use in an emergency. The third type, shown in Fig. 125, consists of a tubular switch with a single knob, which acts both as transfer and pendent switch. The control is shifted from the pilot switch by moving up the knob, while the table is traversed slowly by turning the knob to right or left while the knob is in the upper position. A guide is provided inside the switch to prevent improper use.

A very interesting development of the reversing motor drive for planers eliminates the magnetic controller entirely. In addition to the planer motor, there is a motor-generator set, consisting of a driving motor wound to suit the shop voltage, a direct-current generator, and usually an exciter. The leads of the generator armature are connected solidly to those of the armature of the planer motor. The fields of the planer motor are connected to the exciter always in the same direction, while there is a reversing switch between the leads of the generator fields and the exciter. The direction of rotation of the planer motor is determined by the polarity of the generator, which in turn is determined by the position of the reversing switch. In this way the planer is reversed by the reversal of the generator field. As this field current is always less than



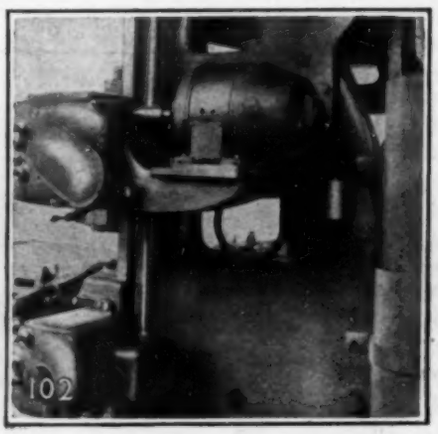


Fig. 101—Planer with electric feed and power traverse. Fig. 102—Feed motor on a 48-in. planer Fig. 103—One form of pendent switch

10 amp., the reversing switch may be much lighter in construction than one designed for reversing the armature current, which may rise to 200 amp. when starting a 25-hp. motor. The result is a simple equipment which requires much less attention in the shop than one that reverses the armature current by the use of magnetic contactors.

A planer with one of these drives is shown in Fig. 98. There are two forms of reversing switch for the generator field. One is a small, low-capacity switch such as is used with standard magnetic planer controllers, together with a pair of reversing contactors that make and break the field circuit in air by the aid of magnetic blowouts. The other switch shown in Fig. 99 makes and breaks the circuits directly under oil. In breaking the highly-inductive d.c. arc., the oil carbonizes, but this fact seems to be of no importance, as one switch has been run for over two years without changing the oil in the switch, and with only one hour's maintenance time charged to it. It is recommended, however, that the oil be changed at intervals of approximately three months. It is felt that this type of equipment is preferable, as it eliminates part of the equipment, and thus makes the drive as a whole simpler and more reliable.

In case of a power shut down, which disconnects the motor of the set from the line, the planer will continue to operate, gradually slowing down in speed, until the table comes to rest. Should the table throw over the master switch, the table will reverse, even after the motor-generator set is disconnected from the line. Where magnetic contactors are used, the reversal depends on the closing of the reversing contactor, with the result that the table will probably overtravel the rocker further than will the table of an equipment having an oil reversing switch.

Methods of Control

With a motor-generator drive, two methods of control are available. In one case, the planer-motor speed is varied by a combination of control of the planer-motor field and of the voltage furnished by the generator. In the other, a substantially-constant generator voltage is used, and the speed of the planer motor is varied by adjusting its field only. Equipment using both field and voltage control is inherently a constant-torque, variable-horsepower type for that range in speed secured by voltage control. It is particularly advantageous where speed ranges greater than four to one are desired, as practically any desired speed range may be obtained. It is seldom that ranges greater than six to one are desirable, however, although one equipment having a fifteen-to-one range has proved very satisfactory.

The straight field-control equipment is used where the total desired range is not over four to one. It is believed that a constant-voltage equipment is faster and more satisfactory than one operating on variable voltage, and it is known that is is cheaper for a given horsepower than the adjustable-voltage equipment.

With adjustable-voltage, constant-torque equipment, the question arises as to the rating. The two companies furnishing such apparatus in this country pursue two radically different policies. One rates the equipment on the horsepower developed at the lowest speed, while the other gives a nominal rating which is from one-third to three-quarters greater than the horsepower at the lowest speed. It is felt that this last is a mistaken policy, and that the equipment should develop full horsepower at the lowest speed, at which it is very likely that most heavy cuts will be taken. The average shop man is not very familiar with electrical equipment, and it is believed that when he buys an equipment he expects it to develop rated horsepower over the whole of his available cutting range.

The extreme accuracy possible with the reversing motor drive can be observed in Fig. 100. The right hand of each cut stroke was ended with the tool in the solid metal, without a runout, so that any overtravel or irregularity of stroke would show up very clearly.

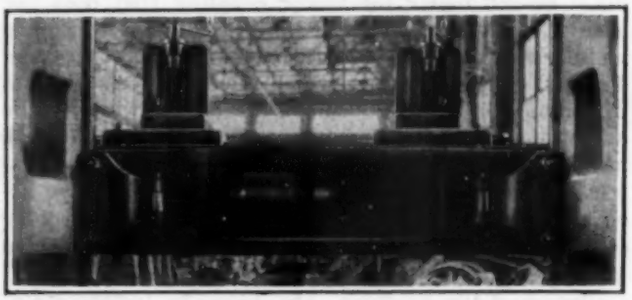


Fig. 104—Clamping motor on planer crosshead

For traversing the heads of a planer or elevating the cross-rail, one or more small motors are usually used, with some simple form of reversing controller. The motors, which are used but a small proportion of the time, need only be rated for five-minute service, but should be completely inclosed to prevent the settling of dust inside the motor. Such motors when used on direct current may have either compound or series field windings, but it is believed that series motors are preferable when the motors are directly coupled or geared to the machine, as the shunt field on such a motor seems more likely to give trouble than the series field.

Electric feed motors are now more and more extensively used in place of feed boxes driven from the main driving gears of the machine. The electric feed, originally developed for the larger planers, and almost exclusively used on planers larger than 72 in., is now being used on much smaller sizes, because of its reliability, accuracy, and the ease with which it may be adapted to give both feed and power rapid traverse of the parts. Fig. 101 shows a very late design of planer having electric feed and power traverse to all heads through the small compound motor which may be seen at the end of the rail.

There are three types of electric feed in use. In one the amount of feed is governed by the number of revolutions the feed motor revolves. This type is used extensively in England, but in this country has been used more particularly on slotters. It has the advantage of eliminating ratchets and devices for adjusting the amount of the feed, but has the disadvantage of giving a feed which is not positive, and which varies somewhat with the load. It is for this reason that it is used on slotters and not on planers. Slotters have but the one member to be moved, with consequent small variation in the load, while planers may have from one to five heads, with a consequent variation in load of at least five to one.

The second type, which is the most common, has a motor which operates a given fixed number of revolutions at each end of the stroke. A crank transfers the

motion to the operating rods and screws by means of ratchets, which may be set to feed the head in the desired direction. This method is better than the previous one for planers.

In the third type the feed motor is operated at one end of the stroke only for a fixed number of revolutions. Fig. 102 shows the mounting of a feed motor of this type on a 48-in. planer. The small drum switch to the right of the motor throws the feed from one end of the stroke or the other, as may be desired, while a drum switch under the motor coupling that does not show very clearly in the cut limits the motor to a fixed number of revolutions when it is on automatic operation. The end of the stroke at which the feed takes place is determined by the position of the small switch, while adjustment in the amount of feed is obtained mechanically. This is the best of the electric feed systems, as it is less likely to cause trouble, is more accurate, and operates the feed motor but once for each cutting stroke against twice for the more common method. This method is easier for the motor, the controller, and the machine, and helps to reduce maintenance costs.

To use the feed motor for traversing there may be furnished a two-button push button, located in any desired position, or a pendent master switch to control both the driving and feed motors. One convenient type of switch, that shown in Fig. 103 is cylindrical and has a single knob. When the knob is in the lowest position both motors are controlled by the pilot switch. Pushing the knob to the upper position stops both motors and locks the switch in that position, with the rockers inoperative. In between there are two positions. At one, the feed and traverse motor may be operated for traversing the heads or elevating the rail by turning the knob either to the right or to the left. At the other, the driving motor may be run at low speed in either direction by turning the knob in the direction it is desired that the table will take.

As may be seen in Fig. 101, this type of control puts the movements of all parts of the planer at the control of the operator, who can, if the machine is properly designed mechanically, make all necessary movements of the machine at will without moving from the operating position.

Accuracy in Braking

It is not very practical to use alternating current for the feed motor as dynamic braking is required to secure the necessary accuracy of braking. This equipment may be used in an a.c. shop by belting a small d.c. generator to the main a.c. driving motor. Where the motor-generator type of control is used the exciter may be large enough to supply power to the feed motor as well as to the fields of the generator and planer motor.

Yet another motor is sometimes used on the larger planers. This is a small motor that operates the mechanism for clamping the cross-rail to the housings and unclamping them. This electric clamp, shown in Fig. 104, is a very valuable feature on the larger machines, as it makes easy and quick an operation that formerly took an appreciable time, and involved severe manual exertion. Also the clamp may be so designed that the rail is clamped much tighter to the housings than would be possible with hand-clamping methods. This is the common practice and with a good motor-operated clamp the cross-rail should be clamped at least 50 per cent tighter than is possible by hand. The motor used for this service should preferably be a fully-inclosed series-wound d.c. motor, with a resistor of about 10 to 20 ohms shunted across the armature. The motor should be especially designed to allow it to stall as the rail is clamped, or as the clamping mechanism comes to a stop in the unclamped position. It is advisable to have the motor capable of being stalled across the line for at least 3 to 5 min. without injurious heating, although it is not intended that the motor shall be operated at any time for more than 10 to 15 sec., so that the longer period is solely a safety feature. Any type of reversing controller may be used, but a small reversing drum is the cheapest, and is satisfactory.

Design Mock-Ups Applied to Special Machinery

By John F. Hardecker

WHEN Bill Smith entered the restaurant where he and Jack Brown, his fellow chief draftsman were wont to have their weekly luncheon together, he found Jack already seated and feverishly sketching on his menu card. He quietly seated himself opposite Jack, and it was some time before Jack even looked up, so deep was his concentration. When he did notice Bill, Jack apologetically remarked, "Bill, you know that intricate special machine we are designing for the Star Co., well we've got it licked mechanically, but I'm worried about the controls. They have promised to send down one of their expert operators to confer with us on the location of the various controls, but it's a hard job to make them all conveniently accessible, and I'm afraid it will be a difficult proposition to explain our layouts and drawings to him, as I understand he is not a technical man. Yet we sure do want to make a success of our initial job for the Star Co."

"Well," replied Bill, "when I visited our old friend Ed Jones out at the Eagle Aircraft Co., I saw them doing something that I believe is the solution to your problem."

"There is nothing so complicated as the cockpit of an airplane, where all the various controls and instruments must be located conveniently to the pilot for operation and observation and yet the space requirements are exceptionally limited. They make a wooden mock-up of all their controls and installation out of scrap lumber, plywood, paper, in fact anything handy, and then have a pilot sit in the pilot's seat and comment upon the accessibility of the various controls. They then modify the installation in accordance with his suggestions, until he is finally satisfied, and then they proceed to make their drawings. Now, why can't you do the same thing with the controls on this special machine of yours?"

"That sounds good to me," replied Jack, "and I'm going to try it out." At their next meeting Jack reported the success of the scheme, remarking that they were even able to make some improvements themselves that had not suggested themselves in their drawings, and that the expert operator was well pleased and was able to give them a few valuable suggestions which they incorporated in their final design. And we must all acknowledge that satisfying customers, when all it involves is changing a few pieces of wood, is much pleasanter and more economical than changing a finished machine.

Santa Fé Repairs Handled with Modern Equipment

By Frank W. Curtis
Western Editor, American Machinist

Stripping and erecting locomotives—Reboring worn cylinders—Machining truck pins, driving boxes, connecting-rod bushings, studs and connecting rods

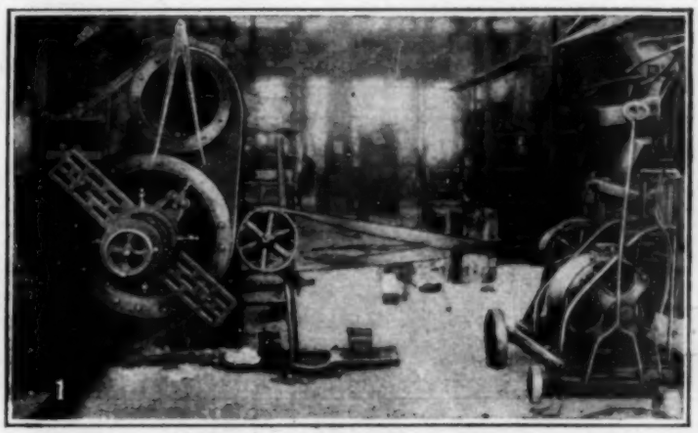
MODERN tools constitute a large portion of the equipment at the Albuquerque, N. M., shops of the Atchison, Topeka and Santa Fé Railway Co., where many labor-saving methods may be seen. The erecting shop, having 26 pits arranged parallel to each other, is equipped with a 250-ton crane for unwheeling and wheeling purposes and two 15-ton cranes for handling lighter work. Unwheeling is done in a pit at the east end, light repairs are handled in eight pits at the west end, and major repairs are distributed to the remaining pits. After an engine has been stripped, it is placed on trucks and transported by the transfer table to an available pit where it remains until it is ready to wheel. If heavy boiler repairs are necessary, the boiler is cut from the frame and taken to the boiler shop, repaired, and is then returned for erection. Stripped parts are cleaned in a lye vat, then sent to their representative departments for inspection to determine the work necessary to recondition them. Repaired units, numbered in accordance with the locomotive to which they belong, are delivered to the east end of the heavy-machine bay so that they will be accessible for erection when wanted.

Cylinders are inspected for wear after the engine has been transferred to a pit. If their condition necessitates reboring, the operation is accomplished by the equipment shown in Fig. 1, comprising the portable boring bar, belt driven by an electric motor, also portable. A roughing and a finishing cut are taken, the finishing tool being of the spring type. Then, the opposite cylinder is bored to an equal size. The cylinder shown measures 24 in. in diameter and 36 in. in length. Different sized spiders, suitable for cylinders of various bores, are part of the equipment.

Bar work, such as cylinder-cock shafts, intermediate shafts and spring rigging pins, are machined in the turret lathe shown in Fig. 2. The work shown is an engine-truck pin, finished to 2½ in. in diameter, and 27 in. in length, on the body section. The end is turned to 2 in. and then threaded by a self-opening die head. The machine is equipped with a set of turret tools for boring, centering and facing operations, also collets for holding bars of miscellaneous sizes. In routing work to the machine, an attempt is made to order parts in quantity lots so that the set-up costs will be reduced. Bar stock is stored in racks adjacent to the machine so that it is accessible when required.

Various operations on driving boxes are handled in the draw cut shaper, shown in Fig. 3, in which a driving box may be seen set up for the machining of its shoe and wedge faces. The work, resting on a parallel block, is clamped against the machine table by a U-clamp. After one side has been completed, the work is turned over and clamped in a similar manner. Driving boxes are run through in sets of six, eight or ten

The first article. The second will appear in an early issue.



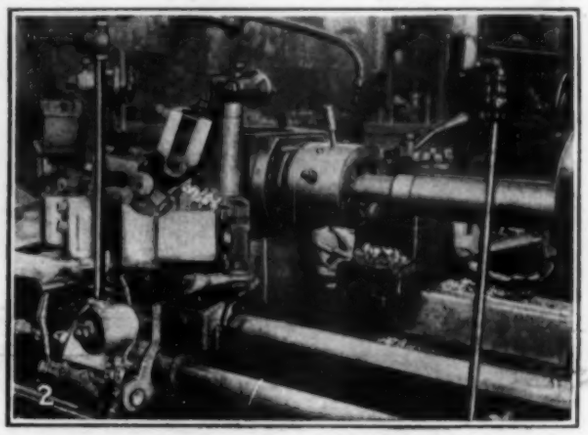
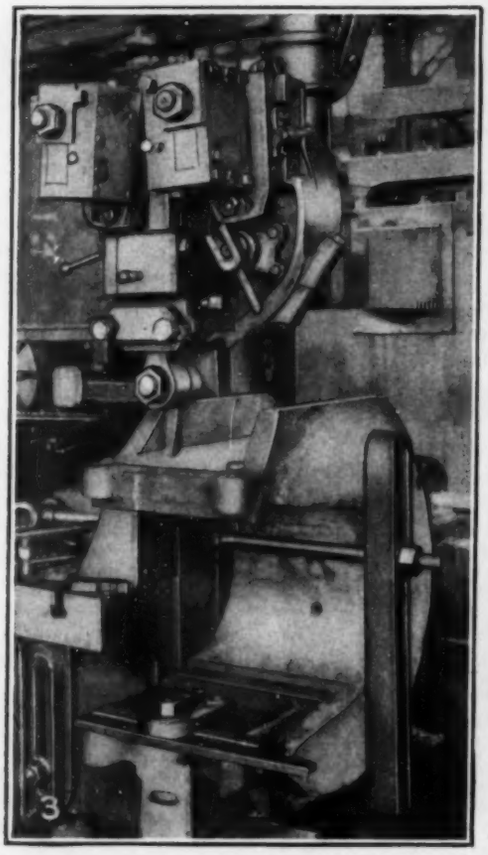


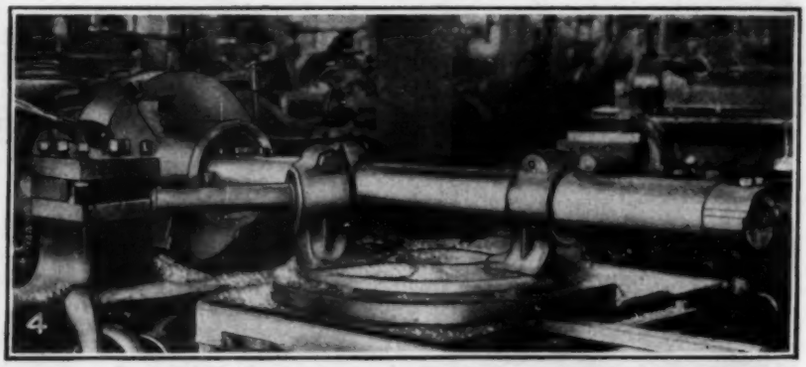
Fig. 1—Portable electrically-operated rig for reboring cylinders. Fig. 2—Turning and threading an engine-truck pin

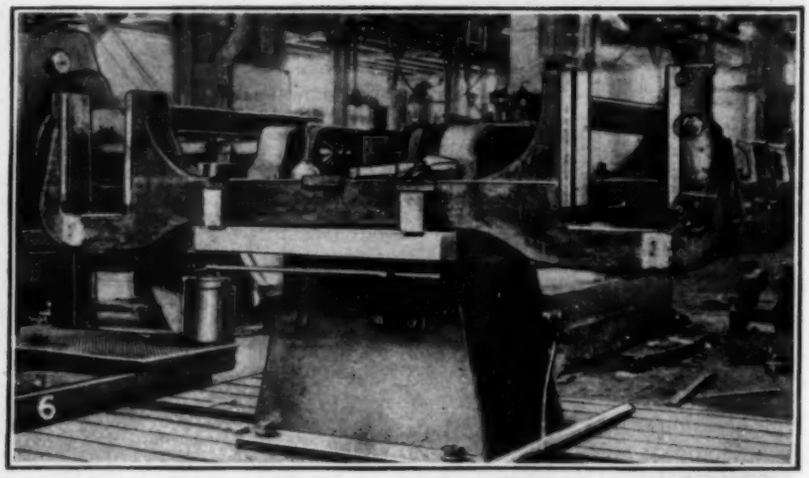
pieces. The machine also handles miscellaneous work on shoes and wedges, and crown brasses.

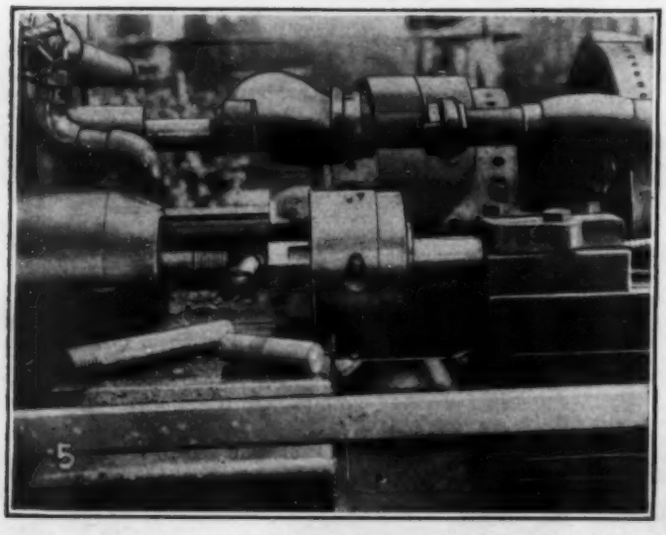
Connecting-rod bushings are machined in the turret lathe, shown in Fig. 4. The machine handles such work measuring up to 10½ in. in bore and 12 in. in outside diameter. The work shown is a class-400 bushing. It is bored to 6 in., turned to 7½ in. and faced to 5 in. in length. The machining necessitates chucking from both ends. Studs up to 2 in. in diameter, used for miscellaneous purposes, are made in the automatic machine illustrated in Fig. 5. The work is run through in large quantities and is shipped to other points in the system where nothing but light repairs are handled.

Cast-steel tender trucks are bored and reamed for the center-plate casting assembly in a horizontal boring mill, as illustrated in Fig. 6. The truck frame is held by four clamps to a sub-base mounted on the machine table, and is leveled by the bottom faces of the pedestal jaws. Four holes are machined in the central cross members by a boring bar that completes the rough size in three cuts, allowing $\frac{1}{32}$ in. of metal to be removed by the reamer. The holes are finished to 3 in. in diameter, into which steel bushings are assembled. Inasmuch as the end portions of the frame obstruct the passage of the boring bar, it is necessary to burn out clearance holes for the operation. The sections re-









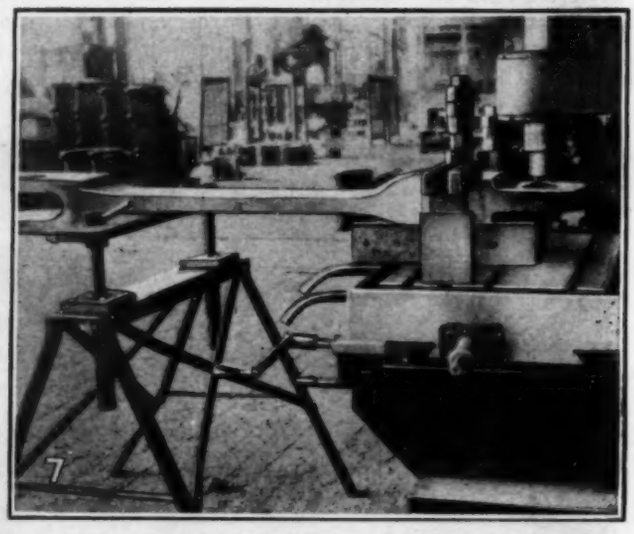


Fig. 3—Machining the shoe and wedge faces of a driving box. Fig. 4—Boring and turning a connecting-rod bushing. Fig. 5—Studs are made in quantity lots in an automatic. Fig. 6—Boring an engine-tender truck for a center-plate casting. Fig. 7—Connecting rod set up for boring

moved are welded in place after completion of the machining. Liners are welded to the pedestal jaws after machining.

Connecting rods, set up for boring, have their outer ends supported by an adjustable stand so that the work can be leveled easily. In Fig. 7 is shown such a set-up in a drill press for reboring the knuckle-pin hole of a middle rod. The hole is finished to 4⅞ in. diameter and 2½ in. in depth, the rod being held on two parallels by a U-clamp. Machines of this type handle all rod boring, including the rods equipped with bronze bushings. To insure proper and regular lubrication of air motors used throughout the shop has led to the construction of the portable greasing device illustrated in Fig. 8. The unit includes a 6x18-in. cylinder, holding 15 lb. of grease. It is mounted to a two-wheel truck having a front leg attached as shown, so that it can stand vertically. The plunger, operated by the screw and handwheel shown, forces the grease through the hose attached to the cylinder. The motor to be lubricated is supported by its handle in either of the two pipe sections shown adjacent to the cylinder. Approximately 100 motors are greased in 8 hr. with the device.

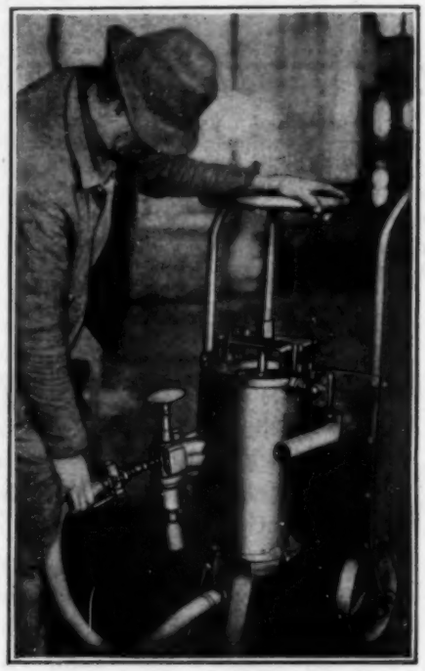


Fig. 8—Portable unit for greasing air motors

Fundamentals of Efficient Vision

THE problem of seeing efficiently is either totally ignored or viewed very superficially for the most part. It is a very complex matter, but it yields to analysis just as any other complexity. Although there are a great many secondary aspects, as a rule there are four fundamental factors. These are: (1) the intensity of illumination which combined with the reflection-factor of the background really resolves into the brightness of the background; (2) the size of the object to be seen which combined with the distance from the eyes resolves into the visual angle of the object; (3) the contrast of the object against the background; and (4) the time allowed or required in distinguishing the object. In the study of visual tasks great progress will be made if these fundamentals are recognized and studied separately.

No general rule can be given in regard to the most desirable intensity of illumination because it depends largely upon the work to be done. However, in general, much higher intensities of illumination would be found profitable throughout industries. Other factors being constant, equally efficient vision requires higher intensities of illumination for lower reflection-factors of the object, for smaller sizes of the object to be seen, for lesser contrasts of the object against its surroundings, and for shorter time in recognizing the object.

In general, the best contrasts usually found are black on white such as in reading matter. However, this is seldom the case in industrial work; that is, the contrast is usually much less. Therefore, if the size of the object or detail to be seen is the same as that of ordinary reading matter, the intensity of illumination in industrial work usually should be much greater than for reading if vision is to be as comfortable and efficient.

Some of the many other factors are the direction, diffusion, and quality of light, and the character of the shadows. Executives and workers should find interest in studying the relation of lighting and vision.

Seen and Heard

By John R. Godfrey

Opposition to machinery

WE'VE been investigated again. Not by Congress this time but by two young English engineers who find that we are prosperous; that our prosperity is sound; that the workers are prosperous and live on a higher scale than anywhere else in the world.

All this is, and rightly, attributed to the extensive use of labor-saving machinery. The general view in England is stated to be that machinery displaces labor and makes fewer jobs, hence the trade unions opposition to machinery. But these engineers are now convinced that the opposite is true.

These engineers are to be congratulated. They've had a good opportunity to see machinery helping make things cheaper so as to make wider markets possible, and these wider markets give increased employment. But there's one point a lot of us overlook—and that is the transition period between the old and new, where it means a drastic change of method and of employment.

The weavers' riot in England that came with the advent of the power-driven loom, was natural enough. The weavers only saw that their jobs were gone and that there was nothing in sight to take their place. If both sides had been farsighted enough to see that cheaper weaving would increase the sale of cloth, the owners might well have run without profit for a time and the weavers worked part time, until the demand increased. It's a bit difficult for a worker to see that machinery may help him sometime next year, when his landlord and the grocer are after his last dollar—now,

Unless the conditions of the country, or of the community, are such that they can in some way take care of the people thrown out of work by new machinery and new methods, the workers are not likely to welcome the change. If other industries could not absorb the surplus workers until the readjustment took place, the question of public works such as new buildings, new roads, water works, etc., might be considered.

The use of labor-saving machinery is bound to increase, and the workers will welcome it with open arms when they are not asked to bear all the brunt of the change.

THE · FOREMAN'S · ROUND · TABLE

Getting New Blood in the Shop

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"SAY, Al, I ran across a mean situation at Cutlerson's shop the other day. They'd fired an old foreman and brought in a new man from the outside. The boys were sore and the new foreman didn't find the job a bed of roses by a long ways."

"Guess you're right, Ed. It's a bad job to tackle and it's a question as to whether it's the right thing or the best thing to do. But there's always two sides to it and the management may have had a good reason for it."

"But, Al, what encouragement is it to a man to try his best to learn the job and then see a stranger come in as the foreman?"

"Darned little, Ed. And yet it may be the only thing to do at times. I don't like it. I think the right sort of management always keeps good men coming along for better jobs. It helps to encourage men to study their jobs and keep their eyes open for new and better ways of doing work."

"But why should they go outside for a new man, Al?"

"Well, Ed, some shops get very rutty and very 'cliquey.' The foreman lets things slide along and the men get careless, and there may not be a man in the shop who would handle the job any better than he is doing. So the only thing to do is to go outside for 'new blood,' as they call it. You get new ideas and there seems to be no other way."

"But what about the men, who see that there's no future for them, Al? They'll think it's unfair and get another job when they can."

"That's true, Ed. It's a mean situation. If I was doing it I'd have a talk with the boys and tell 'em the whole story. I'd tell them that things had gone to seed because we'd neglected to cultivate them. That the only way was to dig up the garden and start fresh. That I hoped they'd wake up so that it wouldn't ever be necessary to go outside again as I'd much rather promote one of them. But that the case had become serious and we had to adopt serious remedies."

"Perhaps you are right, Al, but I'd hate to be the new foreman."

Did Al give a valid reason for hiring an outside foreman?

Would it have been better to try one of the men in the shop even if he were not very promising?

How can the new foreman best get co-operation?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

How Do Mutual Aid Societies Help?

WE WERE up against the need of a mutual aid society a number of times when help was necessary for men who had a run of sickness and had not been able to prepare for the rainy day. Most of our men were willing to help, but it seemed to come too often.

I drew up a set of by-laws for a benefit association, turned it over to the men and with a few changes it was adopted, 50 per cent of the men joining at the first meeting. After two years of operation, and after paying out nearly $700 in benefits, the association has some $1,200 in the bank. The benefits are $10 per week after the first week, and for a period of 20 weeks in any one year. Then $100 is paid in case of death, or $50 on the death of a wife or child. Our membership covers 99 per cent of the employees, and we do not ask them to join. A number of doubtful people said that we could not carry on with the benefits we were paying, but here we are going stronger than ever. To do this, however, we hold drawings or carnivals in the summer and the men are better pleased to help that way than if they were to pass the hat. Most of our men are foundrymen whose work is dangerous, but the benefit society has made them more careful, and they "ride" the fellows who get careless regarding accidents. We could safely say that our accidents have been cut down 25 per cent since the forming of the association. We should be glad to send a copy of our by-laws and any other information to those who are interested.

—W. S. THOMAS, *Superintendent.*

Who Should Do the Discharging?

IF GROUNDS for discharge are limited to insubordination or disloyalty, unquestionably it is the foreman's duty to discharge any man under his supervision who may have placed himself liable to such an extent that discharge is the only course.

However, lack of ability on the part of a workman to maintain the standard of quality or speed set up by his foreman, or his lack of ability to "get along" with his foreman or fellow workman does not always mean that the man is not trying to do what is expected of him. All men are salesmen, selling their services and ability to their employer, and there are no star salesmen who sell every prospect, no matter how high their average.

Most of the cases in which there are apparent reasons for discharge are only cases of no sale, and if the salesman is allowed to display his wares under different circumstances he will make a sale and benefit himself, his employer, and society in general.

Where a discharge is necessary, the foreman must do it or lose the morale of his department. Where a transfer can be made through the personnel department, it should be done by all means, provided that the feeling of the man is not hostile towards his former foreman or employer.

—B. R. SHEETS.

Is the Repetitive Operation to Be Avoided?

IT IS quite true that some workmen have such a temperament that they enjoy monotonous repetitive operations. They have set their standard of living, and as long as the production job pays what they consider necessary to live, they are satisfied. The less thought and responsibility the better. They are willing to endure monotony and drudgery rather than to think and to be held responsible for mistakes. Yet, if they are satisfied with their particular job, they strive to do it the very best they can, and to produce a large output. On the other hand, there are men who have such a temperament that repetitive operations are torture to them. These men have constructive ability, and are not satisfied to sit back and let some one else think out every detail for them. They cannot stand to let themselves be machines, and their constructiveness will turn to destructiveness if they are forced to work that way. The solution to this problem lies wholly in the attitude of the foremen. If a man is satisfied with his repetitive operation job, let him stay there. If he is unsatisfied, and has the ability to learn, the foreman should give him a chance, shifting him around on the different operations in the department, and even give him a chance at job setting. He should shift the man from one thing to another until he is satisfied. The secret to getting the most out of men is to keep them satisfied, and the best way is to give each man a job that fits his temperament.

—JACK L. MORGAN.

THE · NEXT · TOPIC

Hiring Back the Fired Workman

QUESTIONS

Is the man once out always out?

Does the discharged workman ever fit back into the shop, or is reform impractical?

The Practical Joker

MOST of us remember the typical jokes of smearing the rims of our shopmates' glasses with prussian blue or lamp-black, and have been delighted to see that beautiful ring around his eye, but the foolish joker who goes so far as to create sudden shocks to the system, by using electricity, compressed air, water, or other means, is certainly overstepping the lines of common sense, for such jokes are never safe.

A shock to the nervous system is one of the worst forms of injury. Too much cannot be done to teach the joker of the dangers of sudden shocks, for no amount of sorrow can heal them. Al was not too severe on his joker, nor can anyone else afford to overlook foolish jokes of this kind.

—HENRY SEAL, *England.*

Do We Buy Labor or Production?

I DON'T know of any foreman who would care to risk his position by raising the wages of any workman without having a good reason for doing it. But to increase voluntarily a man's wages when observation shows him to be a careful and capable worker, is one of the best ways of keeping him satisfied and willing to do still better. Very often a man will hesitate to ask for a raise thinking he won't get it. Finally he gets the idea he's not appreciated, and when another job is offered him, he takes it. —SAMUEL KAUFFMAN.

NO EMPLOYER buys production; he buys labor, and then depends on his foremen to convert that labor into terms of production. However, an employer always tries to use the productiveness of labor as a measure of its value. High wages and high production depend on each other for existence. High production would soon cease if the market that high wages creates were removed.

Some employers have installed conveyor systems that force the drones to keep pace with the energetic workmen. In a jobbing shop this is not practical, and the only recourse the employer has is to install some form of incentive wage plan or to have a merit system for rating his employees. —H. O. LEHMAN.

I NEVER could understand just why some foremen want their men on the verge of quitting before they will give them a raise in pay. In most cases, when a man asks for a raise in pay, he has already landed another job or knows where he can get one in case the raise is refused, for to me that would mean just about the same as an order for my money.

The class of work, the amount he does, and the quality should govern. If the man is above the average he should be paid above the average wage. No man is hired at the top wage to start. Then why not, as he becomes more proficient in his work, is he not advanced in wages every so often without having to kick? This method would tend to make a man take more interest in his work, and he would do his work in such a way as to be entitled to his raise when due.

—WALTER E. SHANNON.

Shop Visiting for the Foreman

THERE can be no doubt that an occasional visit to other shops will be good for both the foreman and his employer. One is certain to see something different, a new tool or machine, a new method of handling a part or of keeping track of it in the shop, the effect of grouping or line arrangement of the machines on the flow of work for different products, or the general effect of a different lighting system. These things are not necessarily better for being different, but the man is better for knowing that things can be, and are being, done in a different manner. The surest way for Ed to lose that "can't teach me my job" attitude is for him to see how the other fellow does similar work easier or better.

There is another side to the question, too; that of giving as well as receiving from a visit, and as Ed thinks that he knows all about his job, perhaps he will enjoy "showing 'em," and he may even benefit thereby, as one of the best ways of finding out what he does not know about a job is for him to try to describe it to some one else. —A. F. GUYLER, *England.*

SHOP visiting, as proposed by Williams, is undoubtedly a move in the right direction, and Ed is certain to become a better foreman as the result. Visits to other works are apt to provide some rude shocks for some of his pet ideas. The many ways of doing things give one different views, and we see that there is much that can be copied and adopted.

Another side of this question, often much neglected by superintendents, is the visiting of machine tool works and the importance of this education to the machine shop man cannot be overrated. Criticism is usually welcomed, and the foreman who takes part in this is in a fair way to increase the knowledge which is his most important asset. —E. P. TERRY, *Ireland.*

THE firm with which I am connected has tried the experiment of sending members of the staff to visit other works, and the result has been beneficial all around. Williams is on the right track in sending Ed on a visit to another firm. Ed will find many things that will cause him to think more deeply. The exchange of ideas with other people will certainly make him think.

As for Ed not wanting to go because he wants to keep production going in his own shop, he should be the first to recognize that something must be wrong if his department isn't organized sufficiently to allow him to have a vacation now and then. What would happen if Ed had an accident, or was off sick? After the company has seen the result of this visit, I am sure that it will arrange more visits for the rest of the staff.

—E. R. HOWLETT, *Works Superintendent, England.*

Who Should Select New Equipment?

WILLIAMS can't go wrong in putting the choice of new equipment up to his men. First of all, he is getting some valuable advice from the fellows who know. The man who spends 8 or 9 hours a day working with a machine knows a lot about it that isn't in the books.

Around any shop there is always more or less "chewing the rag" about how "they" ought to do things. Such talk, whether believed or not, causes an undercurrent of unpleasant feeling. The best way to stop it is to put "they" out of business, and let "we" take their place. When "we" talk these things over and give our O.K., there won't be much complaint.

If I were a machinery salesman I'd hate to sell one of my machines to a superintendent whose workmen didn't want it. But if the workman helps select a machine he is going to see it make good. The danger of men acting contrary to common sense is less than might be feared. When their ideas are not straight they can be shown, just as Charlie was shown the sense of Ed's observations about the planer. Incidentally, it is a good thing for the foremen and higher-ups to have to explain certain decisions. —GLENN F. GRIFFIN.

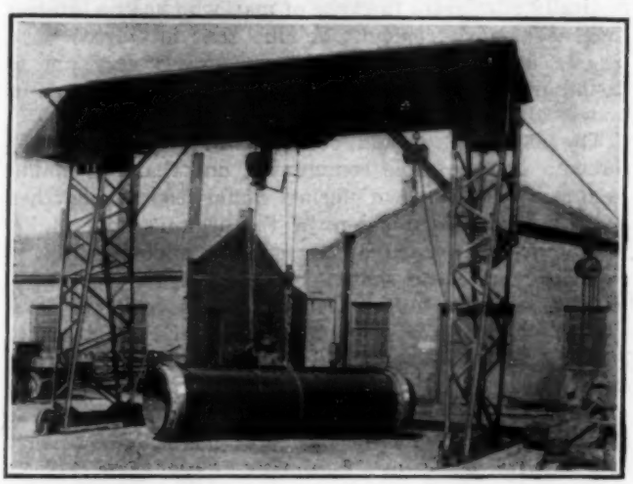
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

A Home-Made Gantry Crane

By Frank Waldo

Needing a gantry crane for the transportation of material to and from trucks and flat cars, the William A. Box Iron Works Co., Denver, Colo., constructed the home-made crane illustrated. It has a capacity of 5 tons and measures 30 ft. between rails. The height of the gap clearance is 20 ft., in which space is operated a Shepard hoisting unit. The wheels, mounted on roller bearings, are of the double-flanged type to avoid the possibility of derailment. The legs are constructed of 3-in. angle iron, and the cross braces are made of 2-in. angle iron. A roof covers the trolley, the hoisting



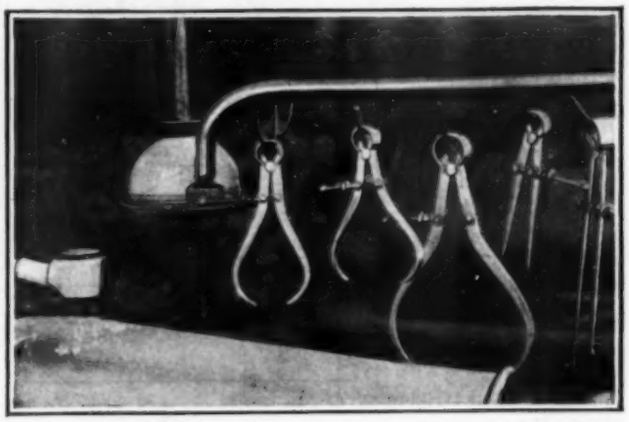
Home-made gantry crane

unit and the bridge rails, thus protecting these parts from snow and rain. To the right-hand leg is attached a "pup" or jib crane, equipped with a 10-ft. beam to which a chain hoist is connected.

Rack for Calipers

By George H. Feltner

When it is necessary to turn in a lathe a number of different diameters on which caliper readings are required, the resetting of one pair of calipers is time consuming, with the result that several pairs are most usually used. Then with several calipers lying on the carriage or lathe bed, there is danger of having some of them jammed between the carriage and the tail or headstock when the carriage is traversed. Having experienced this difficulty I was led to construct the rack illustrated. It is made of pipe, bent and attached to the lathe and is provided with six hooks, hanging from



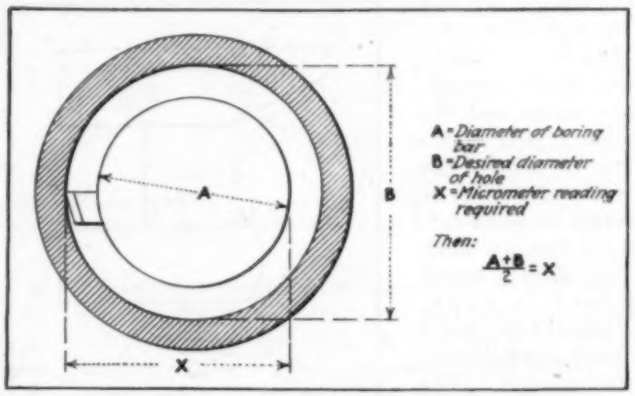
Caliper rack attached to lathe

which may be seen calipers of different sizes. The device has proven so useful that several lathes at the G. C. & S. Fé Shops, Cleburne, Texas, have been equipped with it.

Setting a Boring-Bar Tool

By D. V. Thompson

A lot of fellows will use the cut-and-try method in preference to figuring out a formula. Recently, I noticed a fellow in our lathe department setting a boring tool by the "guess" system. The job was the boring of



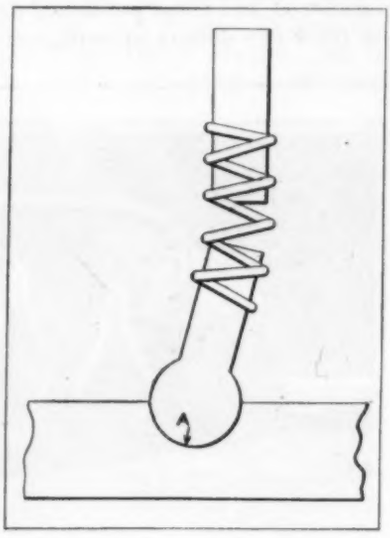
Formula for setting a boring bar tool

the hole prior to reaming it to 1⅝ in. in diameter. The bar was 1¼ in. in diameter, and the hole was required to be bored to 1.61 in. By adding these figures together and dividing the total by two, he could have found the distance from the cutting point of the tool to the opposite side of the boring bar, namely, 1.43 in. The illustration shows the formula.

Lapping Spherical Seats

By Charles Kugler

One of the jobs I had to do while employed as a toolmaker in a large plant making ball bearings, was the lapping of spherical seats in dies for forming ball retainers. The work was done in an ordinary drill press, the lap being rigidly held in a chuck attached to the spindle. Difficulty was encountered at the start, because the lap would not cut at the point indicated at *A* in the sketch. The difficulty was overcome by holding a short bar in the chuck and connecting it to the lap by a helical spring. By moving the work into different positions on the table of the drill press, all parts of the lap were brought into action since the position of the neutral zone was being constantly shifted. In addition, the lap retained its accuracy longer and the abrasive was more evenly distributed.



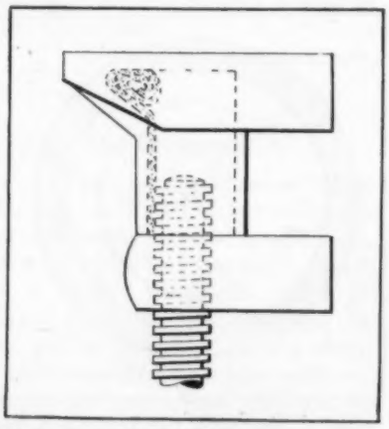
Lap for spherical seats

Oiling the Monkey-Wrench Screw

By Frank Bentley

The modern monkey wrench is a very good tool, and while it would be hard to improve upon it, it could be made more efficient if properly lubricated.

Keeping the adjusting screw lubricated at all times is not a difficult task. All that is necessary is to remove the sliding jaw and screw, and to lay a strip of stiff felt in the space between the screw and the sliding jaw, allowing some of the free end to fold or crimp into the cavity in the jaw head. The sketch shows how it is done. Press the felt down firmly and assemble the wrench. The felt will not slip or turn with the screw after the jaw has been slipped over the wrench shank. If the felt is well oiled, running the screw in and out a few times will lubricate the screw and will make the wrench work much easier. The felt will hold enough oil to lubricate the screw for a long time, and if it gets dry more oil can be put on it.



Oiling pad for the monkey wrench

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Organizing a Foreman's Club

Q. This city has more than 1,400 foremen in various industries, and for several years an endeavor has been made to form a foremen's club, but with little success. Various schemes have been tried. So-called successful clubs have been copied, even professional organizers have been hired, but all have failed. The conclusion reached is that foremen, as a whole, are not interested. Have you any suggestions?

A. Foremen's clubs have been very successful in other places, but it is possible that you have been expecting too much from them. A foremen's club, to be successful, does not need to have a continuous round of activities such as is found in a social or fraternal organization, and in fact does not need to have permanent club rooms.

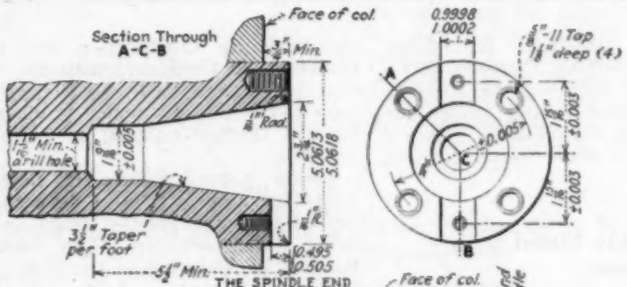
Due to the wide range of differences between foremen in different industries, it may be better if the club is started small, gradually growing as the foremen see that it is to their advantage to join. This method automatically eliminates the type of man who has no interest in general advancement. A club that is started on a large scale by professional organizers is very apt to disintegrate due to the bickerings and criticisms of undesirable men taken into the organization.

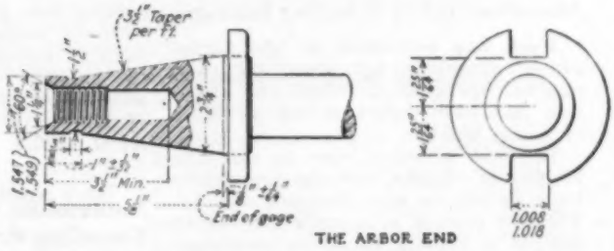
The organizers should look around for the most likely foreman in the whole community, one that the manufacturers and the town officials would respect, and then boost him as the president of the organization. Likewise a foreman with a fair general education and a capacity for work should be boosted for secretary. Finally your committee should see personally at least twenty or more foremen of the city, and get them to sign up as members of the new organization. If the officers selected are the right kind of men they can easily arrange for the club to meet in the factories, in the chamber of commerce, or in one of the schools, so that expenses can be cut to a minimum.

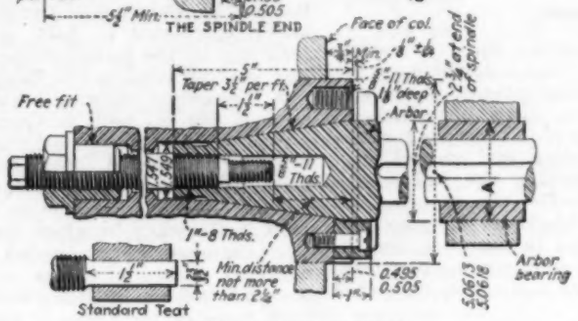
The subjects that can be discussed in a foremen's club are unlimited. Besides those relating to the work of the foremen, they comprise such things as the every-day problems of the community, housing of workmen, personnel problems, and technical matters relating to the industries. It should not be difficult to arrange for speakers occasionally, especially to have officials of the manufacturing companies tell the foremen about the industries in general. Visits to shops can also be arranged. Some of the foremen's clubs are using the foremen's round table in the *American Machinist* as a basis for discussion in some meetings.

The foremen's club should not attempt to compete with social clubs or fraternal organizations. The successful foremen's club is one that, with the minimum of expense and effort can get the foremen of the city together occasionally for a general discussion of problems common to them all. The expenses can be cut down to a small monthly fee to the secretary, and the charges incident to keeping up the correspondence, such as stationary, postage, typing, and mimeographing. Get-together dinners are paid for individually at the time.

Standard Spindle End for Milling Machines







SPINDLE AND ARBOR ASSEMBLY

Standard Teated and Plain Arbors

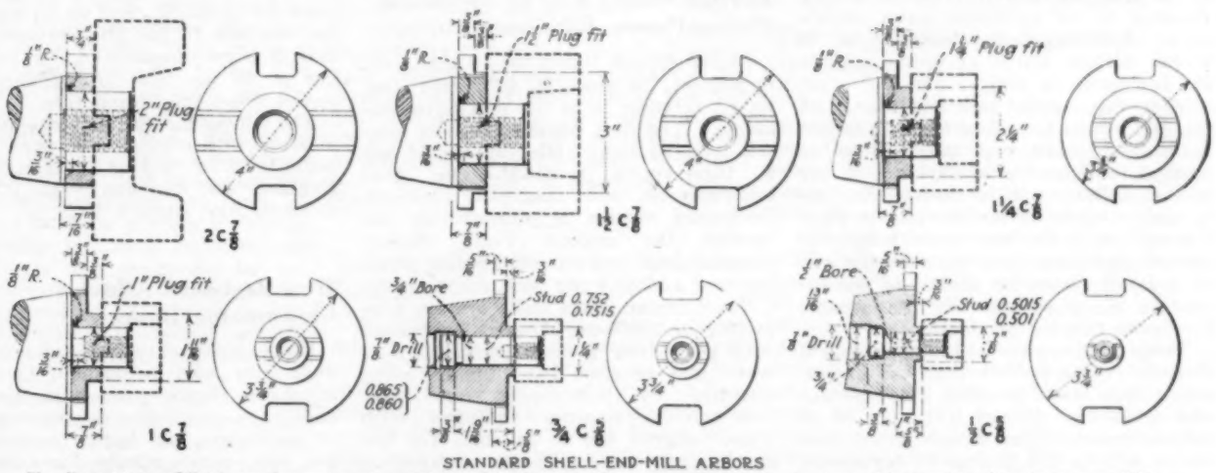
Style *A*, Teated Arbors		Style *B*, Plain Arbors			
Diam., In.	Length, Shoulder to Nut, In.	Diam., In.	Length, Shoulder to Nut, In.	Diam., In.	Length, Shoulder to Nut, In.
⅞	10	1	24	1½	36
1	12	1¼	24	2	30
*1	18	1¼	18	2	36
1¼	12	1½	24	2½	30
*1¼	18	1½	30	2½	36

Note: The standard teat or pilot is to be $\frac{(0.7180)}{(0.7185)}$ in. in diameter and 1½ in. long. The threads for all arbor nuts are to be 10 per inch, American (National) Screw Thread Standard, Class 2 Fit. The Style *B* arbors are to be furnished with two bearings, bearing diameters to be selected by the customer to suit the machine.

*These arbors to have long bearing for arbor pendant.

ARBOR BEARING DIMENSION A

No. 3 .....1⅞ in. for arbors through 1¼ in. in diam.
No. 4 .....2⅛ in. for arbors through 1½ in. in diam.
No. 5 .....2⅜ in. for arbors through 2 in. in diam.
No. 6 .....3⅛ in. for arbors through 2½ in. in diam.



STANDARD SHELL-END-MILL ARBORS

The dimensions of the taper, tapered end, and those of the lugs are the same as for standard arbors, style A and B. The dimensions of the shank, the shank hole, and those of the keys are the same as proposed by national standard.

The standard spindle end for milling machines of 2 to 25 hp. was adopted in 1927 by the following members of the National Machine Tool Builders' Association. Brown & Sharpe Manufacturing Co., Cincinnati Milling Machine Co., Hendey Machine Co., Kearney & Trecker Corporation, Kempsmith Manufacturing Co., R. K. Le Blond Machine Tool Co., Oesterlein Machine Co., Reed-Prentice Corporation, and Sundstrand Machine Tool Co. The arbors are made in three styles, teated, plain and shell-end-mill. The 15 standard teated and plain arbors listed in the table replace about 250 sizes. Standard adapters can be furnished to permit the use of collets and old-style arbors. The draw-in bolt has also been standardized.

The symbol for Style A and Style B arbors is made up of the arbor diameter, style letter, length from shoulder to nut, and bearing number. For metric arbors the symbol is preceded by the letter M and the diameter is given in millimeters. Thus the symbol 1¼A18-4 is a teated arbor 1¼ in. in diam., 18 in. long with a No. 4 bearing (2⅛ in. in diam.). The symbol for Style C arbors is made up of the diameter of the arbor, the style letter C, and the distance from the face of the spindle to the back of the cutter.

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Technical Abstracts

Abrasives Aid in Whaling Industry

Much has been said of the varied use of abrasives, but about the most unusual operation to which our attention has been called is the grinding of whale blubber.

The old practice was to cut the blubber in chunks, put the pieces into huge cauldrons and boil out the oil. The new process is to press the chunks against a rapidly revolving carborundum wheel about 24 in. in diameter by 4 or 5 in. thick, which cuts or shreds the blubber into a fine pulp that is then put into a centrifugator and an absolutely pure, tasteless, and odorless oil extracted. This work has already gone beyond the experimental stage and several vessels are being equipped with the necessary machinery to apply the process.—*Abrasive Industry*, March, 1927.

Consumers' Credit

The expansion of manufacturing plants during and after the war provided excess productive capacity that could only be absorbed by a corresponding increase in consumption. In order to maintain high wages luxury products as well as essential products had to be produced and installment selling resorted to to overcome sales resistance. It is estimated that out of 70 billion dollars worth of goods sold to the consumer in 1925, 5 per cent were sold on this partial payment plan. At the end of the year less than 2¾ billion dollars of credit was outstanding as against total credits of all kinds of 130 billion dollars. It is stated that although a buyer of an automobile pays from 11 to 23 per cent more under the partial payment plan he gets the car at a smaller cost by reason of the reduction made possible by the greatly increased factory production.

Those who regard this plan as of doubtful value believe that the expansion it has made possible is temporary and must be followed by a period of retrenchment. The excess plant now in use will be idle in case of depression and will retard recovery to normal.

Those who favor the plan state that this form of credit is susceptible of more highly specialized control than is bank credit. Those who deal in it have made a special study of it and know more about it than does the average bank about the operations of the diverse industries to which it extends credit. An industrial depression would mean the reduction of the size of installments or even a temporary suspension of payments rather than wide spread repossession.

Credit for consumption is just as essential as credit for production. A large part of the lack of balance in the commercial structure is due to lack of balance between production and consumption. It seems probable that the development of installment purchasing with its accompanying increase in industrial activity will help to stabilize the business situation and reduce the severity of cycle fluctuations.—Donald M. Marvin in *The Management Review*, April, 1927.

Automobile Cars Fitted with Traveling Cranes

To accommodate the increasing freight traffic in automobiles, the Union Pacific has placed in service 1,000 steel cars, each of which is fitted with a 3,000-lb. traveling crane to facilitate loading and unloading.

Runways extending the full length of the cars, enable the cranes with attached chain blocks to be placed at any desired point in the cars, and to be moved to any point while under load. The chain blocks are to be furnished by the shipper.

When not in use, the cranes can be locked at the car ends or at any intermediate point by means of chains and eyebrackets.—*Railway Mechanical Engineer*, March, 1927.

Europe Shows Way to Increased Motive-Power Efficiency

In the second Diesel locomotive built in Europe, the essential difference from its predecessor is in the driving mechanism. The first locomotive had electric transmission, while the second has a three-speed constant-mesh gear transmission and magnetic clutches. Backward motion is obtained by reversing the engine. Tests showed thermal and overall efficiencies of 34 per cent and 29.4 per cent, respectively.

The German State Railways are projecting a 1,600-hp. Diesel locomotive with gear drive giving six speeds forward and reverse, the clutches being operated by compressed air. Four four-cylinder engines equipped with superchargers are to be used for the driving power, and the supercharging is expected to improve the overall efficiency 15 per cent.

A machine works near Stuttgart is completing a compressed-air drive Diesel locomotive of 900 i.hp. and has in project one of 2,500 hp. with combination direct and compressed-air drive.

Europe appears to favor mechanical transmission, while in the United States the trend has been to larger use of electric transmission. Europe uses gas and oil power solely from an economical and efficiency standpoint. It is primarily interested in such matters as first cost, weight, maintenance, depreciation and operating expense. These items must be scaled down to rock bottom if gas and oil power are to compete with steam.

Much progress has been made in standardizing construction and types, especially in Germany, with the result that 210 former locomotive types have been reduced to 16, which number will be still further reduced as experience justifies.

Steam poppet valves of both the Lentz and Caprotti types seem to have passed the experimental stage and are being widely adopted. The former is popular in Austria and Germany. The latter, originated in Italy, is used extensively by the Italian State Railways and is being tried out in England.

A locomotive carrying a steam pressure of 850 lb., built in Germany, has shown a gain in economy of 25 per cent as compared with superheater locomotives operated at ordinary pressures. Another locomotive is being built in Germany in which the combustion chamber is surrounded by tubes carrying saturated steam at 1,420-lb. pressure, the steam being circulated at high velocity by a steam pump. The resulting highly-superheated steam is used in part, directly in the high-pressure cylinder and the balance is returned to the drum from which it was drawn for the purpose of generating additional steam. Exhaust from the nigh-pressure cylinder is discharged into a receiver against a maximum pressure of 257 lb., and on its way from the receiver to the low-pressure cylinders it is re-superheated. A fuel saving of 45 per cent is confidently expected from this locomotive.

The turbo-condensing locomotive is meeting with considerable favor and is being built by various firms in Sweden, England and Germany.—C. B. Page, *Railway Age*, April 2, 1927.

Heat-Resistant Alloys for Carbonizing Boxes

Many nickel-chromium alloys, which were first used because of their electrical resistance properties and their ability to resist the destructive effect of oxidation at high temperatures, are now used entirely for this latter reason. Such alloys, known as heat-resistant alloys, range in composition from 5 to 8 per cent of nickel, 13 to 25 per cent of chromium, and the balance iron. They are particularly useful for carbonizing boxes used in the heat-treatment of steel parts. They have proven effective due to retaining their mechanical properties at temperatures ranging from 1,200 to 2,200 degrees F.

Previous to the use of heat-resistant alloys, carbonizing boxes were made with extremely heavy walls. Even then the material did not last long, and the boxes had to be scrapped after 100 to 250 hours' use. Boxes made from heat-resistant alloys last from 4,000 to 5,000 hr. as a minimum. Though the special alloy boxes cost more, this long increase in life easily

offsets the additional cost. Moreover, the alloy boxes can be cast with lighter walls, and due to the fact that they remain free from scale, they allow a more rapid and efficient transfer of heat. The nickel-chromium alloy boxes are now almost universally accepted as standard for heat-treating purposes.—*Inco*, April, 1927.

A Non-Destructive Test

Lack of a conclusive and at the same time non-destructive test of a welded joint has prevented the wider use of welding. In the plant of a manufacturer of high-grade automobiles where the bodies are made of welded steel the welded joints are tested by means of a large welding blowpipe. The inspector runs his blowpipe back and forth along the welded seam until a zone one and one-half inches wide on each side of the weld reaches a medium red heat. If the weld is sound the seam shows up as a dark stripe. Defective places show up as bright spots and are melted out by the inspector before the piece goes back to be rewelded. The process is rapid and the cost moderate.—*Oxy-Acetylene Tips*, April, 1927.

Homogeneous Lead Coating for Steel

A lead coating process, which eliminates the use of soft solder or tin as a flux, has been developed by the Gross Lead Burning & Coating Corporation of Cleveland. It is being used commercially for steel, brass, and copper containers for corrosive acids.

Pieces to be coated are cleaned by pickling in dilute sulphuric acid and rinsing in clear water. They are then immersed in a pure lead bath. The flux floats on top of the bath and the pieces are coated with it as they are dipped into the molten lead. The pieces are left in the bath until a skin base is formed. Upon this amalgamated base successive coatings are built up by the lead burning process by means of a burning bar and oxy-hydrogen torch. Pieces too large to be immersed are sand blasted or cleaned with emery wheels. The work is preheated, the solution is applied, and the lead put on with burning bar and torch.

Advantages claimed for this process are that it will stand the temperature of molten lead before loosening; the coating will not peel, buckle, crack, or blister; heat expansion and contraction have no effect on it; coated sheets can be crimped, rolled, or beaded without damaging the coating.

The process is being applied for coating pickling tanks in the sheet steel industry, to take the place of wood or steel tanks lined with sheet lead.—*The Iron Age*, April 7, 1927.

Smooth Finish Machining of Low Carbon Steels

Plain and alloy low carbon steels have, under certain operating conditions, a tendency to machine to a rough finish in final cuts.

It was found through extensive tests that, for each steel and its particular heat-treatment, the rough finish was due to a critical range of volume removal rate. This critical range can be avoided, and a smooth finish obtained, through any of the following methods: lowering, or preferably increasing, the cutting speed until it is outside the critical range; maintaining the speed, but changing the cut or feed; sharpening the cutting angle of the tool; changing the hardness of the steel being cut, usually increasing it, in order that a good finish is produced at an easily obtained speed.—*Transactions of the American Society for Steel Treating*, April, 1927.

Some Problems in Machine Tool Manufacture

It has been truly said that the machine tool manufacturer makes the tools that make the machines with which all commercial commodities are produced. The machine tool manufacturer is, therefore, responsible for what may be termed the original development in all lines of manufacturing today.

The greatest problem the machine tool manufacturer has to face, however, has not been the engineering problem of producing machines to meet the exacting demands of his customers, but the economical problem of how to obtain a sufficient price for his product. The purchasing agent may think the price of a machine is exorbitant when he considers only its size and weight; it is hard for him to understand that with a limited production of any one particular type of machine tool the overhead costs are excessive.

In addition, the machine tool manufacturer is expected to maintain a certain amount of excess capacity for building machine tools, due to the fact that the demand is never at an even level, but is almost always either above or below what might be called "normal." —J. G. Benedict, *Machinery*, March, 1927.

Securing Economies by Reducing Overhead

Further striking reductions in direct labor cost in producing automobiles are not to be expected unless by marked changes in method or equipment. Production executives are beginning to realize that the everlasting hammering that has been concentrated on reducing direct labor costs has become futile in view of the greater economies to be secured from a careful study of what we call overhead—usually meaning indirect labor. The two items of material handling and maintenance can alone afford substantial savings if they are studied as carefully as has been the case with production methods.

Machine equipment must be looked upon as an investment and purchased accordingly. Some method of analyzing its economic value is needed that will consider both investment and profit producing angles.

The passing of the industry from the boom period when the only problem was to produce more cars, and the arrival of the keen competition of the present, has made it necessary to study other fields of economy than direct labor. For while direct labor costs have been reduced by the utilization of more highly productive machinery, overhead has been running "hogwild" in the other direction. The industry needs less fancy accounting and more well founded engineering analysis that associates production cause and effect.—W. L. Carver, *Automotive Industries*, April 2, 1927.

Designs Simplified by Electrical Means

Modern motors and controllers have been developed so thoroughly and have proved so reliable in service that there is a strong and growing tendency to use electrical equipment for many purposes for which mechanical means were formerly employed. In designing machinery it is frequently possible to reduce the number of shafts, bearings, clutches, brakes and other parts; thus making the machine simpler, cheaper, safer, easier to maintain, more convenient to control, and more productive.

It is not at all unusual for a number of motors to be used for driving one machine. It may be thought at first that the cost of the motors would be an important consideration in a case of this kind, but the cost of the motors is comparatively low because of the large quantities in which they are manufactured. If the use of an extra motor results in the saving of but a very few gears and bearings it will often be found that the motor costs less than the parts it replaces.—H. L. Blood, *Machinery*, March, 1927.

The Application of Japan by Spraying

When it was first discovered that japan could be applied by spraying, and the first outfit was installed, it was found that work could be done four times as fast as by brushing, even with the crude equipment of that time.

Exhaust cabinets were then equipped with belt-driven fans through which the material had to pass before being blown out of the building. It was impossible to clean the fan without taking it apart and the cabinet was difficult to clean. Later unit-type electric fans were used and the cabinets were lined with paper which was changed once a week. This remains the present practice.

At about the same time that the method of taking the material out of a small cup had been found inadequate, and the gravity method introduced, the idea of pre-baking was discovered. This consists in passing the work through an oven prior to spraying. The work is thoroughly dried and the heat of the work dries the finishing material.

Pressure containers are now used extensively. The only difference that variation in pressure seems to make is in the amount of material wasted. In order to secure a high-class finish care must be exercised to see that there is no water, oil, or dust on the work or in the intake air.—W. J. Miskella, *Fuels and Furnaces*, April, 1927.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Industrial Alliances in Europe

LOUIS LOUCHEUR'S speech to the Berlin Chamber of Commerce adds interest to the economic conference to be held shortly in Geneva. If it is possible, as Mr. Loucheur suggests, to form industrial combinations of nationals of all the European countries to combat the trade penetration of United States products, the business men of America will certainly want to be prepared.

The difficulties of language and tradition that would face a combination of the type suggested appear staggeringly large but stern necessity overcomes long odds. On the other hand, American business has certain legislative handicaps, when it comes to trade combinations, that are not easily disposed of.

If, as Mr. Loucheur suggests, some of the tariff barriers of Europe can be lowered, the increased freedom of trade between European countries that would result should certainly increase the prosperity of all of them and make them that much better able to buy American products.

Uneconomically handled, a gigantic cartel could do much harm. Under skillful guidance, however, it might well help American as well as European business interests by eliminating the profitless selling prices of ignorant competitors.

The scheme is still visionary, perhaps, but its development at Geneva will be worth watching.

Costs—and Overhead

PRODUCTION managers are constantly being pressed for lower costs. In the past these costs have been usually considered in terms of direct labor. And these terms have meant more and better machine tools that would produce more per dollar of wages paid to their operators.

As a result of this effort and pressure, machining costs have been reduced to astonishingly low figures. Continued demand for lower costs is bringing about a recognition that direct labor costs are frequently so low that further reduction must, of necessity, be small. Not that perfection has been reached, but that a ten per cent saving now means comparatively little in actual dollars four times out of five. Attention is therefore being directed to overhead and we are hearing much about savings to be effected in that direction. Commendable as this may be there is always the danger of indiscriminate use of the term. In many plants everything outside of direct labor and material is considered as overhead, and looked on as a necessary evil, to be eliminated if possible.

It frequently happens, however, that money spent on some phase of so-called overhead pays much bigger dividends than anything else in the plant. An example that comes to mind is a special machine tool that paid for itself in labor savings in 90 days. Its cost was charged in machine overhead, but it was in reality a 400 per cent investment. There are also many cases where money spent on indirect labor is highly profitable.

Overhead costs should be considered by all means. But the mistake of considering all overhead costs as useless expenditures should be avoided. It might be better to create new terms for some of the expenses we now lump under the one head and consider an evil.

Co-operation

THE executive who refuses to listen to suggestions, and who attempts to overlook proven facts, usually receives little admiration from his fellow workers. On the other hand, a man who has the ability to compromise at just the right moment, generally is considered an ideal executive, for more economy has been reached by diplomatic discussions than ever has come from deadlocked conferences.

It is often harder to admit an error than to stick to an original theory with disregard of others. Likewise, it is harder to admire a man, regardless of his capabilities, who lacks the ability to understand another's viewpoint than it is to admire one who is willing to listen in. The man who really counts is the one who is anxious to obtain from his workmen as much help as is possible, and is willing to incorporate all the good points suggested. The man who will not compromise may be full of good intentions, but there is a chance that he is near-sighted to the extent that his vision would be improved by looking through the views of his fellow men.

The King Can Do No Wrong

IT WAS said of an equipment manufacturer recently that his attitude was reminiscent of the old belief that the king can do no wrong. The fact that kings are much fewer and far less powerful than they used to be casts some doubt on the truth of the old saying. As to the manufacturer in question his trouble was different. He not only did no wrong but was quite content with himself and his product and so did nothing whatever. There is good reason to believe that if he does not do something soon it will be too late and he will join the political kings in the limbo of the forgotten.

Shop Equipment News

Baker Horizontal Duplex Boring Machine with Hydraulic Feed

THE multiple-spindle duplex horizontal boring machine shown in the illustration was developed by Baker Brothers Inc., Toledo, Ohio, for simultaneously boring the idler-shaft, mainshaft and countershaft bores in two automotive transmission cases. Although the machine and fixture were designed for this particular class of work, both can be modified within wide limits for different boring operations.

The heads on each end of the machine slide on wide, carefully-scraped ways and each is driven by a direct-connected motor mounted on the saddle. Feeds are obtained by Oilgear hydraulic mechanisms with duplex cylinders for each head. Each head also has independent Oilgear pumps driven from a single motor mounted on the back of the machine. The control levers are placed in convenient positions so that the machine can be stopped at any time in case of emergency.

The spindles have independent adjustments to take care of grinding of tools. All gearing and bearings in the head are lubricated from a pump located on top of each head, direct-connected by gearing to the drive shaft in the head. The fixture is mounted on Timken bearings and is indexed by hand. The bottom of the fixture frame is cored out so that chips from the boring operation fall inside the main frame of the machine onto a screw-type conveyor that carries them to the end of the machine and discharges them.

The sequence of operation is as follows: The operator chucks the work, indexes the fixture, and starts the feed by means of a treadle shown in the photograph. One pedal is provided for each head but both can be engaged at the same time. The heads are rapid traversed until the drills engage the work, when the heads advance at a predetermined feed rate. At the end of the feed, the heads are automatically and rapidly withdrawn to their original starting position and stopped.

The weight of the machine as shown complete with fixtures is approximately 15 tons.

Hisey-Wolf Combination Grinding and Buffing Machines

A line of motor-driven combination grinding and buffing machines has been developed by the Hisey-Wolf Machine Co., Cincinnati, Ohio. The machines can be had in the floor type as shown in Fig. 1, or in the bench type as shown in Fig. 2. Fig. 1 also shows the machine equipped with the incased-type spindle extension which, because of its rigid, double ball-bearing construction, is recommended for heavy-duty buffing, polishing and scratch-brush work. The open-type spindle shown in Fig. 2 is recommended for use with close-corner work.

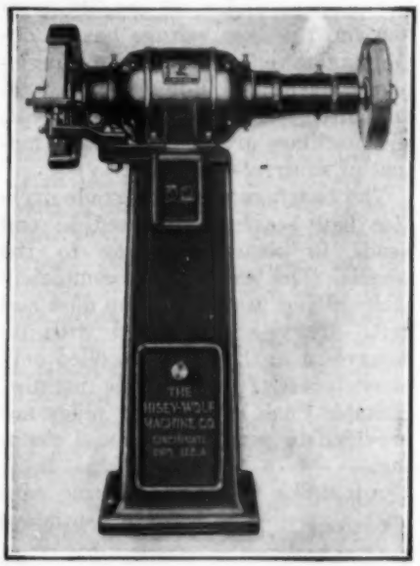
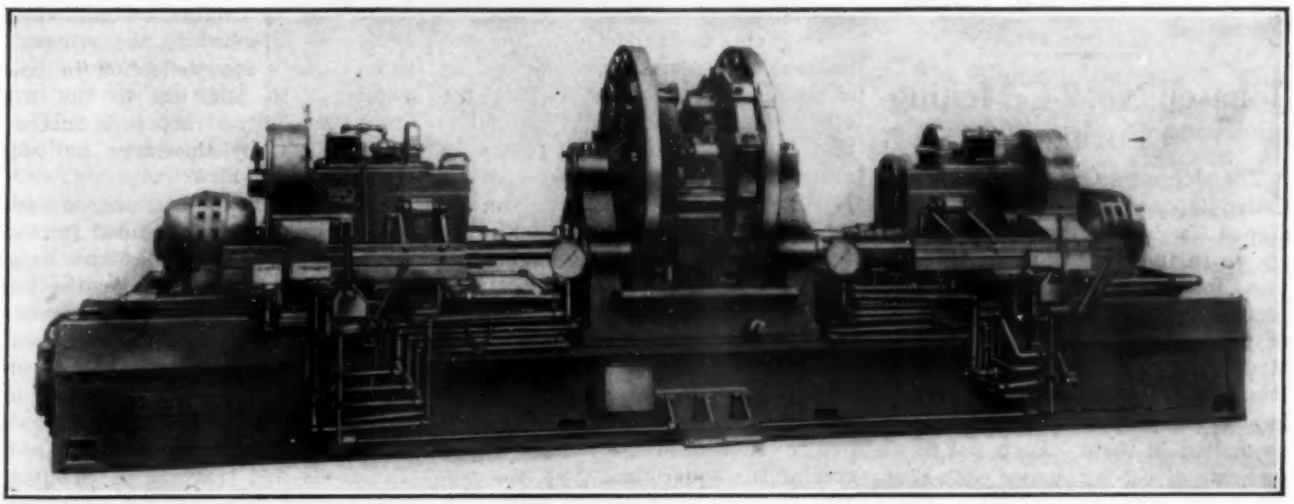


Fig. 1—Floor-Stand Type of Hisey-Wolf Combination Grinding and Buffing Machine

For use with single-phase alternating current, the machines are equipped with improved commutating-type, repulsion-induction motors,



Baker Horizontal Duplex Boring Machine with Hydraulic Feed

Shop Equipment News

which are said to start and pick up speed instantly under any load within twice their rated capacity. It is further claimed that the starting current under all conditions is low and that low voltage has no objectionable effect on these single-phase machines. For use with two- and three-phase alternating current, the machines are equipped with motors of squirrel-cage type.

The bearings are high-grade oversize ball bearings mounted in end heads in close proximity to the wheels. The bearings are completely inclosed and protected from dust and grit. They are provided with oil reservoirs so they need be filled only about every two or three months. Suitable flush or draining plugs are provided to permit occasional cleaning.

Automatic motor starters with push-button control are standard equipment and are designed in accordance with the standards of the Electric Power Club.

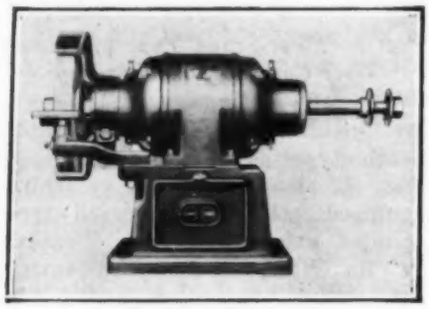
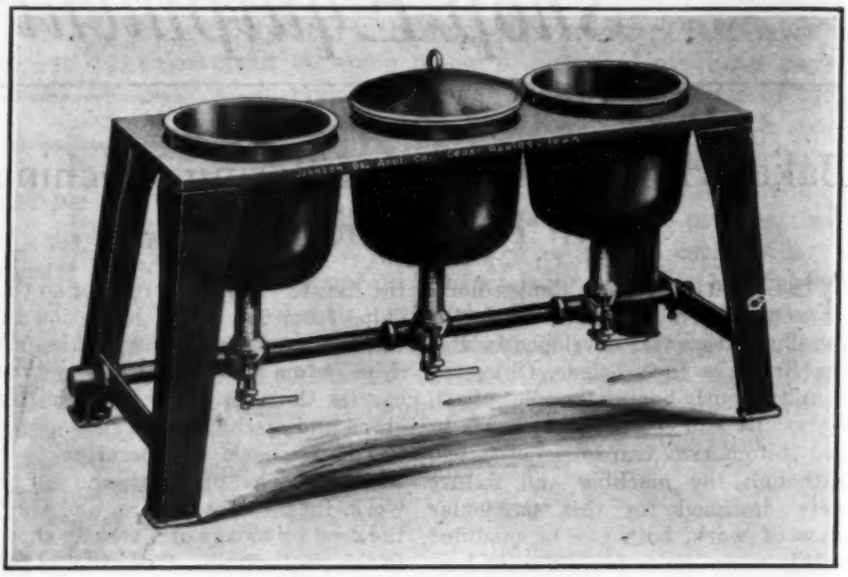


Fig. 2—Bench-Type Machine

The grinding wheels are of diameters in proportion with motor speeds to give safe but efficient operation as recommended by the American Engineering Standards Committee.

Johnson No. 2-C Melting Furnace

The Johnson Gas Appliance Co., Cedar Rapids, Iowa, has recently designed the No. 2-C melting furnace, shown in the accompanying illustration, for use in re-babbitting connecting rods. The furnace consists of three melting pots, heavily constructed of cast iron with suitable lids. Any soft metal, such as lead, babbitt, tin, zinc or type metal, can be melted in them. Each pot has a separate direct-jet burner with shut-off valve and pilot light. These burners are known as Johnson No. 5 Type-A Bunsen burners, and each has a gas consumption of about 15 cu.ft. per hour. Each pot is 6 in. in diameter by 4¼ in. deep.



Johnson No. 2-C Melting Furnace

The first melting pot is used with hot babbitt and the old rod bearing is placed in this pot. When the old metal has melted out of the bearing, the connecting rod is placed in the middle pot and is re-tinned. The third pot holds the new babbitt metal, which is poured with a ladle.

The unit occupies a floor space of 25x9 in. with an overall height of 16 in. It has a total weight of 90 lb. crated. The total capacity of bearing metal is 30 pounds.

Niles 18-Foot Vertical Boring and Turning Mill

THE Niles Tool Works Co., Division of the Niles-Bement-Pond Co., 111 Broadway, New York, recently built the 18-ft. vertical boring and turning mill, shown in Fig. 1, embodying many improved features. It is built of considerably heavier proportions than previous types.

The table is supported on the bed on double annular tracks, one as near as possible to the table drive gear, the other close to the table spindle so that the load and bearing pressures are more evenly distributed over the full area of the table. Pressure lubrication is supplied to both the table tracks and the spindle and is returned to the main reservoir in the foundation. The drive to the table is through a totally inclosed gear box in which all the gears dip in oil, which also lubricate the shaft bearings.

The crossrail is of improved design and of the square-box type, the section between the housings being uniform throughout its length. Clamping surface is provided not only against the face of the housings, but also against a section on the inside face of the housings extending back quite a distance. This construction is said to result in greater rigidity. A stiffener or camber beam of deep section is attached to the crossrail and prevents any deflection in this member. In addition to the top brace, the upper structure is further strengthened by the large built-up girder shown.

Two separate motors, one on each end of the rail, are provided for the rapid traverse of saddles and bars, and the only mechanism on the top brace is the motor and driving gears for elevating and lowering the crossrail. Feeds are obtained through gear boxes having sliding gears running in oil. Each head has its own independent and reversible feed. The feeds and traverse of the bars and saddles are engaged or disen-

Shop Equipment News

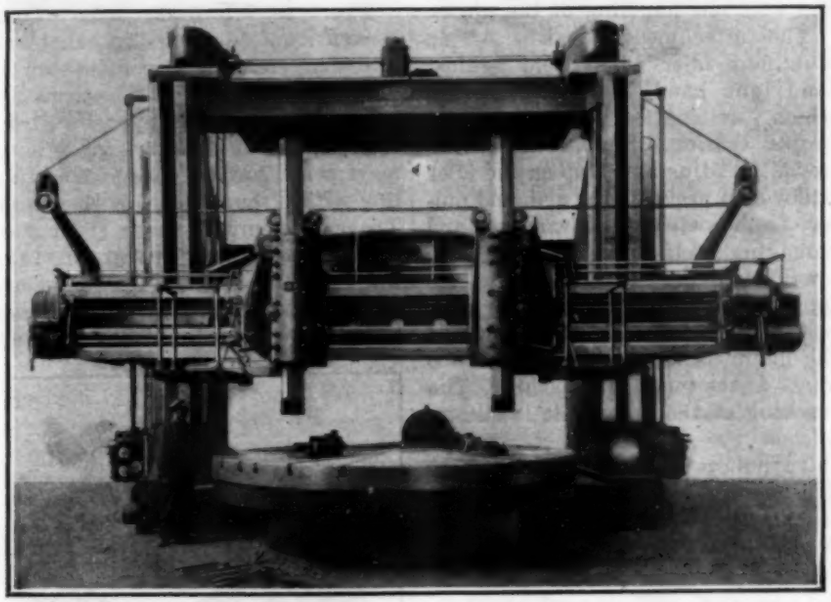


Fig. 1—Niles 18-Foot Vertical Boring and Turning Mill

gaged by means of large friction clutches on the ends of the rail as shown in Fig. 2. The right-hand head is equipped with a special gearing arrangement whereby the saddle and bar feed may be engaged simultaneously for cutting tapers. By means of change gears these tapers can be varied. Both the bars and the saddles have direct-reading micrometer dials graduated in inches and thousandths of an inch to show at a glance the amount of movement these members have made in relation to the reading on the feed or traverse when first engaged. In order to provide safety and convenience for the operator, the operating levers have been duplicated at the saddles and ends of the rail. An adjustable platform with rails on each saddle and at the back and each end of the crossrail as well as around the top brace have been provided, as well as steel ladders for access to the top brace. Counterweights are inclosed in guards of steel wire mesh. For further safety an adjustable limit switch is provided at the top of the housing that automatically shuts off the motor when the crossrail has reached the upper limit of travel.

In other respects the mill resembles other Niles machines turned out in recent years. The boring bars and their support are standard construction as is the method of mounting the driving motor at the central rear.

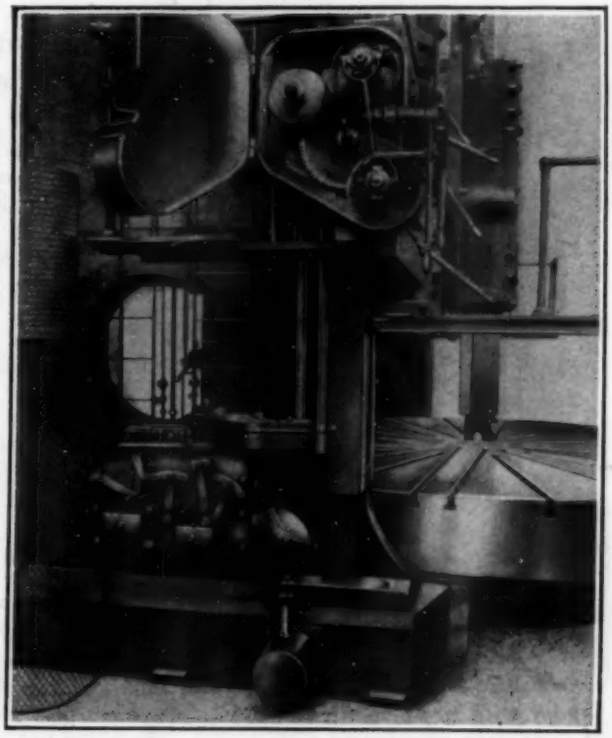


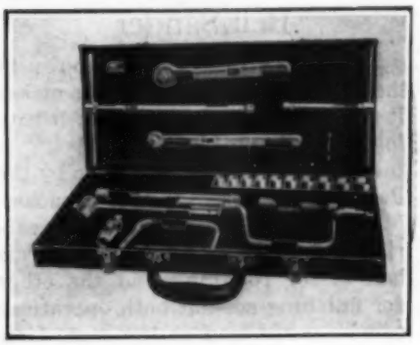
Fig. 2—Feed controls and clutch mechanism

Bonney No. R Socket Wrench Set

The No. R socket wrench set shown in the illustration has been placed on the market by the Bonney Forge and Tool Works, Allentown, Pa.

The set consists of ten chrome-vanadium hexagon sockets ranging from $\frac{7}{16}$ to $\frac{3}{4}$ in., inclusive. The handles are also made of chrome-vanadium steel in the following types: Solid offset; offset ratchet; sliding T handle, 6 and 12 in. long; two brace- or speeder-type handles, one long and one short; two extensions of 5 and 10 in. length; and a universal joint.

The entire outfit is neatly packed in an enameled metal carrying case with leather handle. These socket wrenches are guaranteed to be stronger than the nut or bolt that they fit.

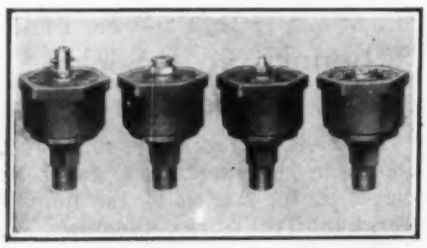


Bonney No. R Socket Wrench Set

Link-Belt "Hex-Top" Malleable-Iron Grease Cups

The Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., has announced a line of "Hex-Top" malleable-iron compression grease cups with Alemite or Zerk fittings. As the name implies, these grease cups are of hexagon shape so as to offer an easy purchase for any type of wrench and also a good grip for hand turning. The particular feature of this line of grease cups is the combination of a compression cup with an Alemite fitting. A grease gun is applied to the fitting when the cap is turned up to a high point so that a good reserve of grease is stored up for future use. An occasional slight screwing

Shop Equipment News



Link-Belt "Hex-Top" Malleable-Iron Compression Grease Cups

down by hand or wrench is all that is necessary until the cup needs to be refilled. This type of cup is particularly recommended for inaccessible places.

Two-Belt Attachment for "Syracuse" Type B-3 Belt Sander

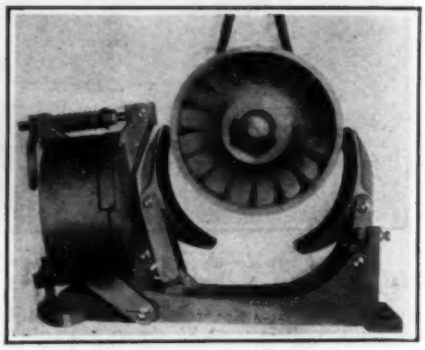
The two-belt attachment shown in the accompanying illustrations makes it possible to use two belts each having a maximum width of 4½ in. on the type B-3 belt sander made by the Porter-Cable Machine Co., Syracuse, N. Y. This machine ordinarily carries a single belt 10 in. wide. One belt is for roughing and the other for finishing so that both operations can be performed at the same time and with one handling of the pieces.

The attachment consists of an aluminum idler pulley held against the right hand belt by a spring which automatically secures the proper tension. Should the spring break, an adjustable stop on the idler pulley arm prevents the arm and pulley from swinging downward and damaging itself or the machine. The lower pulley is straight, while the top pulley is double crowned for each belt. The belt on the side towards the motor is tracked by use of two knobs at the top of the machine. The tracking of the other belt is accomplished by a single knob on the third pulley arm. Each belt is independent of the other as far as tracking, width, and length are concerned.

EC&M Type WB Brake

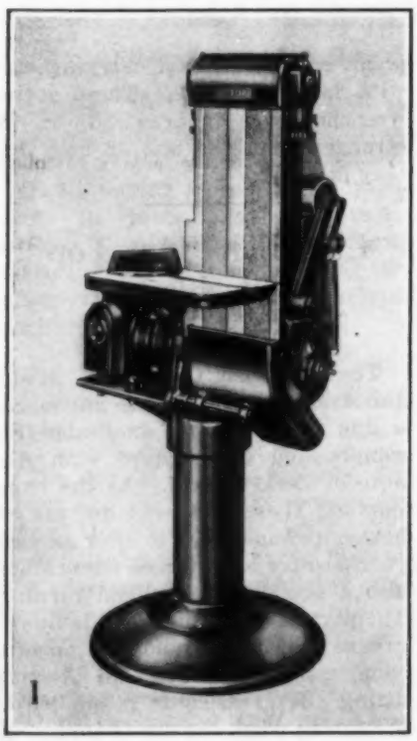
The type WB brake illustrated was developed by the Electric Controller & Manufacturing Co., Cleveland, Ohio, to meet the demand of a shoe brake having long life of lining and to permit the quick removal of the motor armature with the brake wheel in place without the necessity of taking the brake apart or disturbing any of its adjustments.

The type WB brake differs from conventional designs in that no levers or rods pass over the top of the brake wheel. The shoe arms are caused to operate in opposite directions by means of a simple lever movement having the connecting link within the base below the wheel. The entire unit is made from steel castings accurately machined. The bearing pins are oversize to insure smooth operation. The brake shoe linings are made of asbestos inter-



EC&M Type WB Brake

woven with wire and molded to shape under heavy pressure. On the smaller brakes the linings are ¼ in. thick, and on the larger ones ⅜ in. thick so that considerable wear can take place before replactment is required.



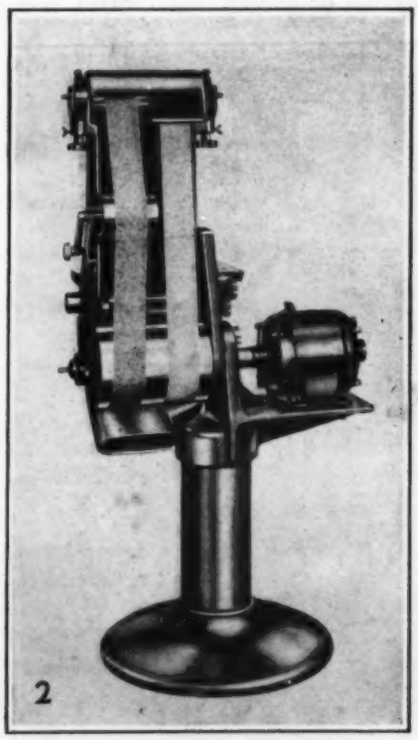


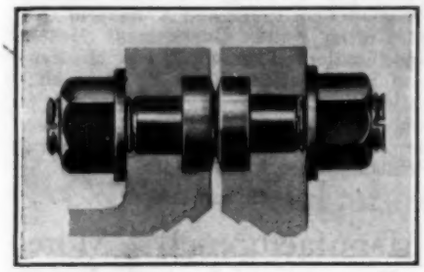
Fig. 1—"Syracuse" Type B-3 Belt Sander with two-belt attachment
Fig. 2—Rear view of the machine with attachment

Brown Shear-Pin Coupling

The Brown Engineering Co., 123 N. Third St., Reading, Pa., has developed a positive-type shear-pin coupling, which tests show will break within 10 per cent of the rated load. A cross-section of the pin is shown in the accompanying illustration.

The pin is made of an electric-furnace bronze of special composition. In order to avoid partial shear under normal load the maximum stress is localized by means of the sharp V-groove. Besides localizing the stress, the notch gives a permanent clearance between the flanges. When the pin breaks the coupling casing or one of the flanges is free to slip axially thus allowing the broken ends to pass each other. The ends cannot possibly pry loose as the enlarged mid-shoulders are held against positive seats by the nuts on the outer ends of the pin. This con-

Shop Equipment News



Cross-Section of a Brown Shear-Pin Coupling

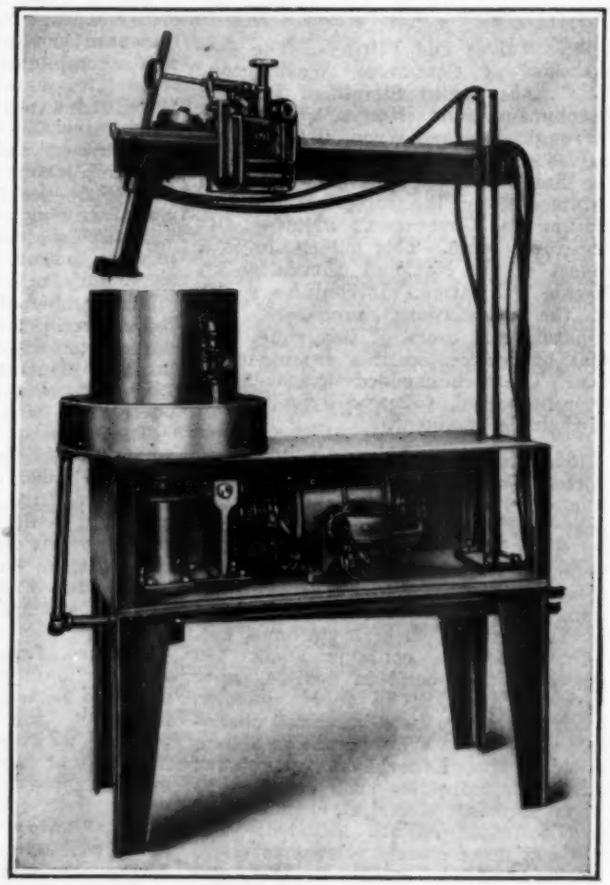
struction also allows easy replacement of broken shear pins.

The Brown shear-pin coupling is made in twenty sizes to take care of shafts ranging from 1 to 11 in. in diam. to transmit a load ranging from 1 hp. at 4,200 r.p.m. up to 1,500 hp. at 540 r.p.m. Standard shear pins can also be obtained.

Lincoln Machine-Driven Carbon-Arc Welder

The accompanying illustration shows a carbon-arc welding machine recently built by the Lincoln Electric Co., Cleveland, Ohio. The machine is automatic in action and will weld circular seams up to 12 in. in diameter. A particular feature is the cooling tubs around the revolving table which carries the piece being welded. This piece may be partially or totally immersed in water during the welding operation and the cooling water is kept in constant circulation. This cooling arrangement was developed particularly to meet the requirements when welding alloy steels in which the heat disturbance due to application of the carbon arc must be reduced to a minimum. In the case of a 12-per-cent manganese steel the welding may be done with the piece totally immersed in water and with the arc submerged. The rapid quenching of the molten metal that takes place preserves the normal physical properties of this class of steel.

The frame and other parts of the welding machines are all made of welded steel construction.



Lincoln Machine-Driven Carbon-Arc Welder with special cooling device

Trade Catalogs

Beam Sections. The Carnegie Steel Co., Pittsburgh, Pa., has issued a booklet on beam sections. It is bound in flexible leather covers and contains 172 pages, 5x7½ in. In it are listed the profiles, properties and safe loads for the new series of structural steel beams and columns sections made by this company. In conformity with other publications of Carnegie, considerable specific engineering data are given.

Chain Drives. The Diamond Chain & Manufacturing Co., Indianapolis, Ind., has issued the third of a series of industrial booklets entitled "Reducing Maintenance and Delays in the Textile Industry." In it the advantages of multiple-roller-chain drives for such machines as spinning frames, roving and slubbing frames, cards, twisters, spoolers and the like are brought out. The bulletin is well illustrated throughout.

Compressors. The Pennsylvania Pump and Compressor Co., Easton, Pa., announces the publication of a new bulletin describing its single-stage air compressors and vacuum pumps. Included in this bulletin is a description of its Class 3-AE synchronous motor direct-connected air compressors. The publication is designated as Bulletin No. 132.

Electric Tools. The Black & Decker Manufacturing Co., Towson, Md., recently issued its catalog No. 14. In it are described and illustrated various tools made by this company such as portable electric drills and stands, screw drivers, socket wrenches, bench and pedestal grinders, twist-drill grinders, portable grinders and tappers, valve grinders, valve refacers and attachments. The catalog contains forty-eight 8½x11-in. pages, and the subject matter throughout is very attractively presented. A price list is also included.

Jig Boring Machines. The R. Y. Ferner Co., Investment Building, Washington, D. C., announces that the Société Genevoise d'Instruments de Physique of Geneva, Switzerland, whom this company represents, has issued catalog No. 438-A describing high precision and jig boring machines, models Nos. 4, 5 and 6. In it are given the details and specifications of these machines as well as the accessories to go with them. The method of automatic compensation of errors of the lead screws is featured, while another section is devoted to the method of boring and cites the advantages of the use of an end mill for rectifying holes after drilling.

Laps, Bench. The Bethel-Player Co., Westboro, Mass., has published a leaflet describing its tool room and machinist's bench laps, which were recently placed on the market. The leaflet is illustrated.

Melting Furnaces. The American Gas Furnace Co., Elizabeth, N. J., has issued bulletin No. 5 describing its gas-fired melters. This line includes regular crucible melters for gold and silver, brass crucible furnaces for melting copper, brass, nickel, and test melts or iron and steel, soft-metal furnaces for babbitt, type metal and the like, and special melters. The bulletin contains eight 8½x11-in. pages and is well illustrated by means of photographs and cross-sectional views.

Motors. The Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland, Ohio, has published Bulletin No. 200 entitled "Type T Heavy-Duty Reliance Motors for Direct Current." This publication contains thirty-two 8½x11-in. pages, wire-bound but punched for insertion in a loose-leaf folder. In it the question is answered as to "Why a more rugged general service motor?" The step by step manufacture of these motors is described in detail aided by numerous illustrations of the various

parts that enter into the machine. Complete tables of ratings are given as well as dimensional data. A number of pages are devoted to illustrations showing typical applications of these motors to all types of industrial equipment.

Sheet and Plate Machinery. The Streine Tool & Mfg. Company, New Bremen, Ohio, has issued an illustrated leaflet showing its various types of sheet and plate machinery.

Tapping Machines. The Western Machine Tool Works, Holland, Mich., has issued Circular No. 7,000 describing the Garvin line of No. 2-X automatic tapping machines. This publication contains twenty 8½x11-in. pages and is well illustrated throughout by means of photographs and cross-sectional views. The various features of these machines are pointed out and their correct use in operation is explained at length.

Transformers. The Wagner Electric Corporation, St. Louis, Mo., has issued bulletin No. 148 on its single-phase distribution transformers, Type HE. A detailed discussion of the construction of these units is given, followed by tables of ratings and dimensional data. The publication is well illustrated throughout and contains thirty-two 8½x11-in. pages. It is bound in attractive paper covers.

Turret Lathes. The Jones & Lamson Machine Co., Springfield, Vt., has issued an unusual bulletin describing pictorially its Hartness flat turret lathes. Seven large-size photographs are used to bring out the following points: Rapid production, no overhanging tools, accurate duplication, simplicity, rigid control of work and tools, and few handles. Aside from the captions, which shout for attention, there is no other text employed.

Welding Equipment. The Smith Welding Equipment Corporation, 2619 Fourth Street, S.E., Minneapolis, Minn., has issued its 1927 Junior Catalog in convenient pocket size. In it is described and illustrated oxy-acetylene equipment of all kinds that this company manufactures. A revised price list to go with the large-size 1927 catalog of welding and cutting equipment is also announced.

Pamphlets Received

Drafts in Foreign Trade. The American Manufacturers Foreign Credit Underwriters, Inc., 381 Fourth Ave., New York, has published its first booklet of a series containing information of practical use to exporters. This publication contains a summary of the legal requirements in foreign countries relating to the protest form and endorsement of drafts. The regulations that prevail in various countries have been arranged in the form of charts, which show at a glance the fees for protesting, stamp charges, time within which protest must be made, the allowance of days of grace, the method of extension, the validity of waiver of protest provision, and the statute of limitations. The various forms of protest are explained in greater detail in the text. The pamphlet contains forty 5½x8-in. pages.

Gear Tooth Forms. The American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y., has published in bulletin form the Tentative American Standard Spur Gear Tooth Form of both the 14½-Degree Composite System and the 20-Degree Stub Involute System. These Standards have been approved by the American Engineering Standards Committee and sponsored by the A.S.M.E. and the American Gear Manufacturers Association. The bulletin may be obtained from the publishers for the price of 35 cents.

Overhead Accounting. The Department of Manufacture, Chamber of Commerce of the United States, Washington, D. C., has published a booklet in two parts, entitled "The Evolution of Overhead Accounting." Part I is devoted to the basic principles in the treatment of manufacturing overhead and it features the development of the machine hour-rate method. Part II is devoted to the designing of the overhead structure and treats of departmentalization; accumulation of overhead; selection of overhead rates such as percentage of labor wages, employee-hour rates and machine-hour rates; rate determination and revision, and unabsorbed overhead. The bulletin is illustrated with charts and contains thirty-two pages bound in paper covers. The text is clear and easily understood.

Pipe Valves and Fittings. The Department of Commerce, Washington, D. C., has issued Simplified Practice Recommendation No. 57, entitled "Wrought-Iron and Wrought-Steel Pipe Valves and Fittings." It is issued by the Bureau of Standards and may be obtained from the Superintendent of Documents, Government Printing Office, for 5 cents. This publication is a report of the National Committee on Metals Utilization. It contains a list of the associations, producers, distributors and users of this equipment that have accepted this recommendation. The recommended standards are then presented, followed by a history of their development.

Research. The report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1925 and 1926, has been published by His Majesty's Stationery Office. Copies of this report may be obtained from the British Library of Information, 44 Whitehall Street, New York, N. Y., at the price of 3 shillings, net. The publication contains about 180 pages and is bound in flexible paper covers. Research in fuels, geology, foods, forest products, buildings, chemicals and patents are reported on among other things. Reports on research for particular industries such as the railways, shipping, electrical, chemical and textile industries are included. The subjects more closely related to metal working include bridge stresses, gas cylinders, lubricating research, machine design, X-Ray analysis of crystals, and more general subjects.

Specifications. The Bureau of Standards, Department of Commerce, Washington, D. C., has published Bureau of Standards Circular No. 319, entitled "Alphabetical Index and Numerical List of United States Government Master Specifications, Promulgated by the Federal Specifications Board." The publication contains twenty 7x10-in. pages and is bound in paper covers. It may be obtained from the Government Printing Office for 10 cents.

Manufacturers Use More Power and Less Labor

The Census of Manufactures for the year 1925, a summary of which has just been made public by the United States Census Bureau, brings out the materially increased use of power in the manufacturing plants of the country since 1919. Not only has the amount of power been materially increased, but the number of wage earners has materially decreased. The average number of wage earners employed in 1925 was smaller by 4.4 per cent than the corresponding average for 1923, and was 6.7 per cent below that of 1919. Approximately 600,000 less wage earners were employed in the manufacturing plants of the country in 1925 than in 1919.

Despite this decrease in wage earner employment, production as measured by the "value added by manufacturers" increased by 8.2 per cent over 1919. As might be expected in view of the decrease in wage earner employment, this increased production per wage earner was accompanied by a considerable increase in installed horsepower over 1923, and a pronounced increase over 1919, rates for the two periods being 8.1 per cent and 22 per cent respectively. During this six-year period, 1919-1925—the primary power of the manufacturing plants was increased by 6,437,037 hp., and from 1914 to 1925 the primary power was increased by 13,333,599 hp., or by 59.5 per cent.

The number of manufacturing establishments in the nation has been reduced from 213,631 in 1919 to 187,386 in 1925. During the two-year period, 1923-1925, over 8,000 plants ceased to operate.

The value of products of manufacturing establishments in 1925 totaled $62,705,714,000, an increase of 1.6 per cent over 1919. This rate of increase, however, would be considerably higher than the rate based on values for the reason that the wholesale prices of manufactured commodities were on the average materially lower in 1925 than in 1919.

Because of the fact that the products of many manufacturing establishments are used as materials by other establishments, the aggregate value of products as given above is considerably in excess of the total value of finished manufactured products in the form in which they reach the ultimate consumer. A very much better measure of the actual value created by manufacturing processes is the "value added by manufacture, or the difference between cost of factory materials and the finished product."

NEWS OF THE WEEK

Capital and Labor Unite in Plan to Eliminate Waste in Industry

Philadelphia leaders in two-day conference

THE co-operation of labor with capital in the elimination of waste in industry was pledged at a two-day conference under the auspices of the American Federation of Labor and the Labor Institute, held in Philadelphia on April 9 and 10.

One of the speakers on the first day of the conference was Fred J. Miller, of Center Bridge, Pa., a former president of the American Society of Mechanical Engineers, who told of the savings that industrial establishments have effected through scientific management and the application of charted methods of production which have taken the place of the haphazard systems which once resulted in waste of profits.

Other speakers during the conference were Dr. Irving Fisher, professor of political economy at Yale; William Green, president of the American Federation of Labor; Morris Llewellyn Cooke, consulting engineer, of Philadelphia; Matthew Woll, vice-president of the Labor Federation; Frank Sutcliffe, president, the John Wood Manufacturing Co.; Adolph Hirschberg, president of the Philadelphia Central Labor Union; Joseph Richie, Philadelphia representative of the American Federation of Labor; John Phillips, vice-president of the State Federation of Labor; Sanford E. Thompson, Boston, president of the Thompson & Lichtner Co.; Robert T. Kent, consulting engineer and chairman of the American Committee on Participation in International Scientific Management Conferences; and William H. McHugh, vice-president of the International Printing Pressmen and Assistants' Union.

High Wages Depend on Efficiency

"The workers understand," Mr. Green said, "that high wages depend upon the degree of efficiency developed among individual workers and the collective productivity of all who are employed.

"Time and experience have developed a new conception of the vital problems which affect industry. Our viewpoint and understanding of the effect of industrial processes upon the welfare of all associated with industry have undergone a most revolutionary change. We now find that the line of separation cannot be drawn between any group or groups, either interested in or connected with the producing forces of industry. The interests of all are woven so inextricably together as to preclude a division of effort or objective.

"One group cannot permanently prosper at the expense of the other, nor is any one group immune from the evil consequences of uneconomic industrial operation. Industry is made profitable and the rewards of industry are increased in proportion to the co-operation established between employers, employees and management."

"Labor-saving machinery is the best friend of labor as a whole," said Dr. Fisher. "The American laborer gets more real wages than the English laborer because he has from two to five times as much horsepower to help him produce. The English laborer gets more than the laborer on the Continent for the same reason, and the Continental laborer gets more than the Asiatic for the same reason.

"In the end, labor gains the most from labor-saving devices. Increased production means simply increased income to society and the wage earner as a class usually profits the most in the end."

Unemployment Is Waste

That unemployment is a great factor in waste, was the assertion of Mr. Cooke, who declared that—"The fact that some of our best workmen are frequently without a job is no longer looked upon as an act of God. On the contrary we have come to know that unemployment is very largely preventable. In fact, regularity of employment has come to be regarded as one of the best evidences of the ability of management.

"What we all want, employers and employees alike," Mr. Cooke continued, "is the substance of continuous employment rather than protection against unemployment."

In referring to efficiency and waste elimination in reducing the cost of production, Mr. Kent declared that "When automobiles were new, a car cost anywhere from $3,000 to $6,000 and but few people could own one.

"As better methods of manufacture came into use, the cost of producing became less, the prices were reduced and more persons bought cars. This cycle repeated itself again and again until today there are not many people who cannot own a car if they desire to do so. And not a man has lost his job by the improvement in methods. In fact, it is due to the steps that have been taken to enable one man to do the work formerly done by two, by five or by ten, that literally hundreds of thousands of men have found jobs at high wages who otherwise would be working on the farms or digging ditches. This has been made possible by two things—power and standardization."

Speaking of efficiency in shop management from the workers' standpoint, Mr. McHugh declared that "Our union discovered some time ago that in virtually every instance an ill-managed plant employs ill-paid labor, simply because the employer takes his profits at the expense of the workers, and the money wasted through the inefficient methods, badly organized plant, and obsolete or bad equipment, is paid by labor through the low wages it must accept."

Summer School for Engineering Teachers

The Society for the Promotion of Engineering Education announces that a summer school for engineering teachers will be established and the first sessions held in the summer of 1927. The Carnegie Corporation of New York has appropriated funds to operate the school for one year.

The establishment of the school is an outgrowth of the investigation of engineering education which the society has been conducting for the past three years. The project was suggested by W. E. Wickenden, director of the society's investigation, as a result of his study of a similar school conducted in England. Two sessions of the school, each of approximately three weeks duration, will be held during the first year. Cornell University and the University of Wisconsin have been tentatively selected as sites and negotiations opened with the authorities of those institutions.

Mechanics a Fundamental

The work of the school will center around the teaching of particular subjects of the engineering curriculum. The teaching of mechanics has been selected for the first sessions since that subject is fundamental to all branches of engineering. The work will be divided into three principal divisions: (a) The teaching of pure mechanics (analytic mechanics); (b) the teaching of the applications of mechanics in related fields; and (c) exposition of methods of teaching in general. The teaching staff will be selected from among the foremost teachers of the engineering colleges and from among the faculties of teachers' colleges and departments of education of the universities. For the first year, at least, the school will be conducted under the general supervision of the society's board of investigation and co-ordination, which board is charged with the duty of conducting the general investigation of engineering education. Immediate supervision will be in the hands of H. P. Hammond, associate director of investigation.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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NAPOLEON is said to have described China as a sleeping giant whose awakening might bode ill to the Western World.

One is reminded of this observation by the week's news from the Orient where the "Northern" and "Southern" armies seem to be battling for the domination of what used to be called "The Celestial Empire."

But Americans and Englishmen who know the Far East insist that there is no real nationalism of feeling there, and that the conflict which seems to be raging in China is simply a fight between certain mercenary officials for the right to tax the people, and to collect what is called "the squeeze." It is claimed that the troops are really janizaries whose services are for sale to the highest bidder, and that the battles are fought with dollars rather than bullets. If this be true, the so-called "revolution" will end when the money is exhausted and the fear that China will be involved in a prolonged and exhausting conflict is unwarranted. Most of the merchants and bankers who do business in China seem to take this view.

In reviewing the week, first place is given to the foregoing because the "Chinese situation" seems to be causing some uneasiness and may be misinterpreted unless the facts are understood. The truth seems to be that the Chinese giant is still asleep and that his nationalism and agressiveness have been greatly exaggerated. But even if this were not the case, we should have but little reason to be nervous about the effect upon our trade. United States exports to China in 1926 were worth only $110,000,000 and our imports from that country in the same year had a value of but $119,000,000. In proportion to our total trade, these sums are negligible, and it is only from the standpoint of humanitarianism and world politics that we need be seriously concerned about conditions in China.

Nor is there any occasion for worry about our internal affairs. The week's developments have all been of a routine character. Call money has been a little higher and stocks are a shade lower. Brokers' loans are nearly up to the previous maximum and since everyone is preaching caution, a precipitate break in the securities market has become unlikely. But this is not to say that a further advance impends or that prudence in stock market operations is not the better part of valor.

The United States Treasury statement showing that our gold holdings on April 1 amounted to $4,598,782,795 has attracted wide attention. This sum is more than half the world's estimated stock of monetary gold. The inference is that a prolonged period of easy money is ahead and that a continued demand for investment securities is assured. In the circumstances it is a little surprising that there is not more speculation in commodities, for some of them seem to be relatively cheaper than the stocks and bonds that art bought.

WHAT'S DOING IN INDUSTRY

A BETTER tone exists in the machinery and machine tool market. The past week has seen the opening up of new avenues of sales, and more than one improvement is noted in the volume of orders and the character of inquiries.

NEW YORK dealers are encouraged by the receipt of some business from sources that had been holding off buying. A substantial part of the recent half-million dollar Ford order for equipment has found its way into this territory. Manufacturers in New England continue busy, some export business being added to the volume. Hand-to-mouth buying is furnishing good business in the Southern industrial districts. Canadian trade is flourishing in the wake of increased industrial activity throughout the Dominion.

INDIANAPOLIS reports a slight increase in sales to automobile manufacturers, and better prospects from general industry. Conditions in Cincinnati are spotty, but on the whole better than last week. Detroit notes a slight improvement, but much hinges on the future activity of Ford and his close competitors.

THE RECENT placing of large orders for press equipment by the Ford Motor Co. seems to confirm rumors of a radical change in the product of that company. A definite knowledge of what this change will be is expected to eliminate some of the uncertainty in the automobile industry.

The domestic consumption of cotton during March was the largest on record for any month in any year and the ease with which the biggest crop ever grown is being disposed of continues to amaze the trade. But despite the large consumption there are no signs of overproduction in the market for cotton goods. The demand is excellent and if any serious curtailment in next season's yield of raw cotton should threaten a sharp advance would probably be unpreventable.

In sugar the evident strength of the statistical situation is at last commencing to make an impression and a scramble for an unsold supply in Cuba seems to impend. In the markets for coffee, rubber, tea, rice and the other less important agricultural products there have been no new developments. The *quidnuncs* continue to predict a price war in the automobile trade but they probably under-rate the good sense and self-control of the leaders in the industry. A prominent stock exchange firm says that out of a total of 565 automobile companies organized in the United States, only 38 now survive. Some consolidations there may be and while the talk of lower prices persists, sales are likely to be curtailed. This curtailment may account for the slight reduction in the demand for steel and the comparative quietude of copper. But the situation in the metal industry is, upon the whole, satisfactory.

Distributive trade is fairly good but it does not impress one as being fully up to last year and some clouds are to be discerned in the states of the West, South and Southwest.

The commercial failures during the first quarter of the year, as reported by R. G. Dun & Co. also show a somewhat ominous increase. The following is the record, since, and including, 1920:

Year	No.	Assets	Liabilities
1927	6,643	$ 69,204,418	$156,121,853
1926	6,081	63,824,844	108,460,339
1925	5,969	65,493,279	128,481,780
1924	5,655	89,582,982	184,865,571
1923	5,316	101,613,363	138,231,574
1922	7,517	155,856,571	218,012,365
1921	4,872	122,717,522	180,397,989
1920	1,627	17,653,469	29,702,499

The rather high rate of commercial and financial mortality, thus disclosed, is chiefly due to the agricultural depression. Therefore, it is reassuring to read that President Coolidge is at work upon an administration farm relief bill whose passage he will urge when the next Congress meets.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW YORK

Despite more than one opinion to the contrary, there appears to be a fair volume of machine tool business in this market. Many substantial orders are still being held up, but on the other hand there has been a loosening of purse strings that has brought profitable business to many dealers.

The long-awaited closing of the B. M. T. list was begun last week with the placing of orders for planers, shapers, radial drills, a punch and shear, engine lathes and turret lathes. Several dealers profited by this order. Purchases of single tools were also made last week by the Gulf Coast Line, the Chicago, Indianapolis & Louisville, the Lehigh Valley and the Lackawanna railroads. At least three orders for special tools were received from machine tool builders.

Industrials were included in the week's activity. Some purchases by this class were a 62-in. boring and turning mill, two 16-in. lathes, 3 die sinkers, 2 jig borers, 2 special drilling machines, a vertical surface grinder and an automatic centering machine.

The Ford Motor Co. placed orders last week totaling half a million dollars for presses, dies and tools. Some of this business reached this market. Another encouraging feature of the week was the receipt of an inquiry for 65 tools from the Missouri, Kansas & Texas R.R. This is the largest list received in some time.

NEW ENGLAND

Machinery and allied industries in New England continue busy, business in some places and lines being better than elsewhere. Outstanding events of recent occurrence were the merging of the Draper Corporation and the Hopedale Manufacturing Co., the Draper interests coming together again. The Draper Corporation acquired the assets of the Hopedale company. The Sullivan Machinery Co., at Claremont, N. H., has been given an order amounting to $1,000,000 for mining machinery to be delivered to Russia.

Automatic production machinery sales have been fairly good during the past two weeks, the automotive industry being well represented in the buying. Buying for export shipment is reported to have been good. Small tools have been fairly well taken. The holiday shut-down was for the most part limited to the Good Friday observance.

INDIANAPOLIS

While business in the machinery and machine tool trade here is not as good as the trade expected, it could not be called bad and in many lines there is increased activity. With some industrials production schedules are being increased, and in such cases they are more ready buyers than they had been for some time.

The automobile plants in this section are good buyers and judging from their order files, they will continue in the market most of the summer. The last two weeks has seen some increase in the volume of sales to garages. Grinding and abrasive machinery is moving more readily than it has been in recent months. Drills, bench lathes and similar tools are moving more easily.

Some demand continues to come from farm implement factories in Evansville and South Bend, but the volume is below what it has been. A good demand is being received for contractors' equipment and this business should show a marked improvement during the next month. Inquiries are heavy.

Several inquiries are being received for railroad equipment, but actual sales are slow. Demand for special wood-working machinery is only fair. Where some furniture factories are working to capacity, others are cutting their schedules. Used

SOUTHERN DISTRICT

Though Atlanta machinery and tool distributors state nearly all of their business continues to be on a hand-to-mouth basis, sales compare favorably with those for the corresponding period last year. Business in the first ten days of April increased a little over that of the last ten days of March. Inquiries also are more brisk, and should these develop the average volume of orders, April will exceed March by a good figure, and at least equal the business of April 1, 1926.

Some good sales of road building equipment have been reported to various Southern states for road building and maintenance work planned in the coming spring and summer, and indications are that this business will continue quite active for the next two or three months. Sales of contractors' equipment and building machinery, however, have failed to show any appreciable gains as yet, due to the slowness of new construction in this district, and are considerably less than they were at this time a year ago. The present outlook would appear to indicate a less than normal volume of this business for the 1927 season.

Smaller shops are placing a few orders for used and rebuilt machinery, but buying very little new equipment. Service stations and garages are not buying as actively as last year, but their orders are close to normal for this period. Textile mills are inquiring on a good basis and placing a few sizeable orders, while the outlook is very good in this field due to the large amount of mill construction going on in this section. Railroad orders have lately shown improvement and a normal season seems in prospect.

CINCINNATI

Reports of machine tool manufacturers in the Cincinnati district vary as to market conditions in the past week. Some report a slight loss in sales, some report neither loss nor gain and some report a slight gain. Selling agents report that in the week they did a little better than to hold their own.

A few orders called for small lists, but the bulk of the week's bookings was made up of orders for single tools and replacements. The greater part of the sales were to general machinists and miscellaneous users. A number of sales to concerns in the electrical industry are reported and lists on hand indicate further requirements. Railroad orders were confined to single tools and replacements, and the same was the case with concerns in the automotive field. The week's buying was well scattered among the different sections of the country and well diversified as to sizes and types of tools purchased.

The greater portion of the manufacturers and selling agents state that inquiries came in freely during the past week, but there are a few who report a falling off. Inquiries received were well scattered over the country. The major portion of these were from general machinists and miscellaneous users. Some fair-sized lists came from concerns in the electrical industry

DETROIT

Conditions in the machinery and machine tool fields in Detroit have improved slightly in the past week, but there is still no heavy buying. Most of the automobile plants are maintaining a schedule of employment and production a little below normal. The General Motors plants in Detroit, Pontiac and Flint are all busy and are maintaining a high production rate. However, they are making few changes at this time.

Few of the automobile plants are placing big orders for materials, although it is still generally felt that much activity is due. The Ford plants are buying cautiously and at present they are unwilling to divulge the extent or the nature of their plans. That very definite and widespread changes are being planned is generally assumed.

Many of the dealers have been receiving numerous inquiries about toolroom and die equipment and this gives rise to the feeling of optimism that has prevaded this field for many weeks. Most of the firms are making plans for a big summer season and it is expected that the Ford announcement will bring about many changes in the products of the other automobile companies.

Employment figures have remained stationary and the general business tone is unchanged.

CANADA

Present indications are that machinery and machine tool manufacturers in Canada will be decidedly busy throughout the second quarter. Already the markets have been brightened by heavier and more consistent specifications, and a greater degree of liveliness in new business and inquiries. Sales of tools and equipment showed marked improvement during the first two weeks of April.

The yearly report of the Canadian Fairbanks-Morse Co. shows a continuation of the betterment noted in the operations of the company in the previous year, with a very substantial increase in profits and a general growth in business.

Canadian companies are receiving extensive orders for material and machinery for the big pulp and paper plant of the Lake St. John Power and Paper Co. in the Saguenay district of Quebec. Some half dozen companies have received large orders for steel, paper machines, steam plant, grinders, barkers, etc., for this big enterprise.

Foundries are reported to be in good shape, generally. A pipe foundry in Toronto has considerably more business on hand now than at this time last year. One brass foundry in the same city is working to capacity, while export business is said to be maintaining production in the stove and furnace plants. Electrical equipment plants are active, and are reflecting the normal healthy development of industry and business in general.

Automotive production is continuing at a good pace. The general concensus of opinion is that this year's output will be considerably ahead of 1926.

Metal Trades Convention Will Concentrate on Foremen Training

The call for the twenty-ninth annual convention of the National Metal Trades Association is announced by President Paul T. Norton, for the Statler Hotel, Detroit, on April 26. The committees state that there probably has never been a metal trades convention with as many real issues as will be considered in Detroit. The results of two years' of research work in industrial education and industrial relations will be brought before the convention by the respective departments under the titles of "Pension Plans" and "Training of Foremen."

The analysis and treatment of labor conditions which the industry knows is not what they seem to be on the surface, will be entered into along several different lines at a special joint conference of the administrative council, the presidents of the branches, the branch secretaries, and a number of the members who will reach Detroit on the day before.

The additional features on the convention program include the following speakers: Hon. William H. Donovan, Washington, D. C.; Brig. Gen. Ruggles, Washington, D. C.; Virgil Jordan, National Industrial Conference Board, Inc.; E. G. Plowman, of the Associated Industries of Massachusetts; C. F. Klinefelter of the Federal Board of Industrial Education.

The annual banquet will be held on Tuesday night. Hon. Charles A. Eaton, of New Jersey, will be the speaker. He will speak on the subject "The Place of Industry in Modern Life."

Safety Conference at Pittsburgh

The fourth annual Safety Engineering Conference was held in Pittsburgh April 14, under the auspices of the Western Pennsylvania Safety Council, with which are associated the American Society of Safety Engineers—Engineering Section, the Pennsylvania Department of Labor and Industry, the Engineering Society of Western Pennsylvania and other important groups. All sessions were held at the Chamber of Commerce Auditorium, with the evening banquet at the Fort Pitt Hotel.

C. E. Ralston, Safety Director, Pittsburgh Plate Glass Co., presided over the morning session which was opened by R. S. Shoemaker, superintendent of maintenance, the American Rolling Mill Co., speaking on "Electrical Hazards in Industry," after which discussions were led by John James, of the Carnegie Steel Co., and A. Heckman, of the Westinghouse Electric and Manufacturing Co. "Causes of Crane Accidents" was discussed by Frank Rowe, safety director, the Wheeling Steel Corporation, and M. C. Goodspeed, safety engineer, the General Electric Co.

The afternoon session, presided over by N. V. B. Ziegler, manager of personnel, the U. S. Aluminum Co., heard "Infection from Lubricants," a speech by George W. Pressel, chief research engineer, E. F. Houghton & Co., followed by a discussion led by T. A. Little, of the industrial division of the General Electric Co. The final feature of this session was a symposium, or general round table, discussing "Unusual Accidents—That Can Happen Anywhere."

Foremen's Convention in Cincinnati

The National Association of Foremen will hold its fourth annual convention in the auditorium of the Cincinnati Zoological Gardens, Cincinnati, on May 21. The morning topic will be "The Foreman as a Business Manager of His Department," and will be discussed by four well known speakers. A barbecue lunch will be served at noon. The afternoon will be given over to entertainment and informal business matters. In the evening a banquet will be served in the clubhouse.

Reservations must be made in advance to E. H. Tingley, secretary, 1249 U. B. Building, Dayton, Ohio. Advance programs will be sent upon request. All foremen, superintendents, personnel directors and others interested in better foremanship are invited.

Spring Sectional Meeting of Steel Treaters

The spring sectional meeting of the American Society for Steel Treating will be held at Hotel Pfister, Milwaukee, on May 19 and 20. The regular meeting of the board of directors of the society, the recommended practice committee, and several other committees will be held on the day before. On the same evening will be the usual "Early Birds'" dinner and theater party, with technical programs scheduled for Thursday morning and Friday evening.

Many interesting plant inspections have been planned, including Allis-Chalmers, the International Harvester Co., A. O. Smith Corporation, and a number of others. The banquet and entertainment will be on Thursday.

Papers will be presented by J. V. Green, of the Chicago Steel and Wire Co.; R. S. Archer, of the Aluminum Co. of America; H. B. Northrup, of the J. W. Kelley Co.; Harold Woods, of the Ingalls-Shepard Division of the Wyman-Gordon Co.; R. N. Sandberg, of the Columbus Tool Steel Co.

Simonds Essay Contest

Announcement has been made of the sixth annual essay contest sponsored by Alvan T. Simonds, president of the Simonds Saw and Steel Co., of Fitchburg, Mass. Each year Mr. Simonds has offered prizes totaling $1,500 for the best essays on practical economics. The subject for the essay this year is —"Who Ultimately Pays the Taxes?" The contest closes Dec. 31 and the winners will be selected by a committee of prominent educators and experts in economics. Details of the contest may be obtained from the Contest Editor, the Simonds Saw and Steel Co., Fitchburg, Mass.

Hoover Will Address Foreign Trade Convention

Foreign traders from forty states will hear an address by Secretary of Commerce Hoover on May 26 at the fourteenth national foreign trade convention, according to O. K. Davis, secretary, who has just made public the convention's program. The convention will meet in Detroit on May 25, 26 and 27, and 2,500 foreign traders are expected to attend.

The address of the Secretary of Commerce will be delivered at a special luncheon session, under the auspices of the American Manufacturers' Export Association. Its subject will be "American Foreign Trade," and a nation-wide radio audience will listen in to what is anticipated to be one of the notable business addresses of the year.

Among other outstanding features of the convention will be addresses by Roy D. Chapin, chairman of the board, the Hudson Motor Car Co., on "The Motor Influence in Our Foreign Trade;" Governor Fred W. Green, of Michigan, on "Michigan's Vital Interest in Foreign Trade," and Silas H. Strawn, chairman of the board, Montgomery, Ward & Co., "Foreign Uses for American Capital."

F. Edsel White, chairman of the board of Armour & Co., will preside at the luncheon session of the American Manufacturers' Export Association, and C. K. Woodbridge, president of the International Advertising Association will be in charge of the export advertising session.

More than forty speakers, prominent in all phases of the country's foreign trade activity, will address the thirteen group and general sessions.

Following the precedent of last year the platform of the convention will be turned over at the first afternoon session to foreign trade spokesmen from Canada and representative leaders from the different sections of the Dominion who will put before the delegates the kindred problems of Canada and the means for promoting friendly business co-operation across the border. A delegation of 500 Canadians is expected to attend the convention under the auspices of the Canadian Board of Trade. The convention will also serve as a meeting ground for many other delegates from the British Dominions and will be addressed at the general session on May 26 by speakers from Australia, South Africa, Irish Free State and other parts of the British Commonwealth. Another visiting delegation of great interest to American foreign traders is the group of Latin-American business men, who will attend the convention following the Third Pan-American Commercial Conference which meets in Washington earlier in the month under the auspices of the Pan-American Union. A general invitation has been extended to all delegates at this conference to remain over for the Detroit convention, where they will be represented on the program and where special acquaintance plans will be promoted on their behalf among American foreign traders interested in Latin-American trade.

Business Items

The Goodrich Grinding Wheel Co., of Chicago, is the new name adopted by the firm formerly known as A. Goodrich, Inc.

The Kemp Machinery Co., of Baltimore, has moved into new quarters at 211 President St.

The A. E. Carle Machinery Co., of 546 E. Woodbridge St., Detroit, has been established to deal in used machine tools and to act as plant liquidator.

The Chambersburg Engineering Co., of Chambersburg, Pa., has opened offices at 613 Machinery Hall, West Washington St., Chicago. D. M. McDowell is in charge.

The Rome Wire Co., of Rome, N. Y., announces the establishment of a warehouse at 622 West Adams St., Chicago. A complete stock of electrical wires and cables will be carried. F. R. Weaver, district manager, is in charge.

Smith & Wesson, Inc., firearms manufacturers of Springfield, Mass., have closed their plant indefinitely. About 500 employees are involved in the shutdown. Depression in the revolver business is given as the reason for closing.

Increase in the volume of business has made necessary the construction of a new machine shop by the Philadelphia Gear Works. The new building will adjoin the company's present plant and will be located on Erie Ave. and G. St., Philadelphia. It will be a two-story building, 400 ft. long by 130 ft. wide. The cost, including the land, will be about $450,000.

Frank Fageol, of Detroit, former head of the Fageol Motors Co., which operated a plant here recently transferred with Fageol Motors to American Car and Foundry Co., is arranging for the promotion of a new bus manufacturing company. The company is to manufacture and market a new type bus to be known as the "twin coach." The company already has been incorporated under Delaware laws with $4,000,000 in preferred stock. The concern is expected to take over the Kent plant of the American Car and Foundry Co. Production of the new coach was to start immediately.

Personals

J. C. TERRACE has been appointed Pacific Coast sales representative for the Union Twist Drill Co., of Athol, Mass.

J. C. JONES, formerly president of the Cleveland Steel Co., is now president of the North American Airways, Inc.

H. C. PIERLE, sales manager of the R. K. LeBlond Machine Tool Co., of Cincinnati, sailed for Europe on the "George Washington" on April 20. He will remain abroad for several weeks.

H. F. WALKER, secretary-treasurer of the Canadian Fairbanks-Morse Co., Montreal, has been made vice-president of the company. Mr. Walker joined the company as comptroller in 1920.

F. H. SAGER has joined the sales force of the Foote Bros. Gear and Machine Co., of Chicago. He was formerly Chicago representative for the Ajax Flexible Coupling Co.

SHERROD E. SKINNER has been added to the board of directors of the Skinner Chuck Co., of New Britain, Conn. He is at present a division superintendent of Landers, Frary & Clark.

C. H. WHITE has been appointed manager of the Chicago office of the Brown Hoisting Machinery Co., of Cleveland. He was formerly attached to the company's office in New Orleans.

C. S. BRADEN has been appointed general manager of the Canada Cycle and Motor Co. Ltd., Weston, Ontario, after 21 years service in the sales department of the company. During the past year Mr. Braden held the position of sales manager.

JAMES E. REDMAN has been appointed assistant to the president of the American Bosch Magneto Corporation, of Springfield, Mass. He will devote his time to the expanding of the sales program of the company. Mr. Redman was formerly connected with the Biflex Co.

J. H. TREGOE, for the past twenty-five years associated with the National Association of Credit Men, will retire on July first. He has been executive secretary of the organization for many years. He will continue with the association in an advisory capacity.

J. D. HUNT, JR., formerly a department manager with the firm of W. A. Neal & Son, of Atlanta, road building machinery distributors, recently organized the Jeff Hunt Road Machinery Co., at Columbia, S. C., and established general offices and warehouse accommodations for the handling of a full line of road building machinery and parts for distribution in the South Carolina territory.

R. S. GRIFFITH has been elected vice-president of Griswold & Co. Ltd., of Montreal. Mr. Griffith has been connected with Griswold & Co. for the past two years. He was formerly the Canadian sales representative for several years for Vickers Ltd., of London, England, and then for a year or more was general sales manager of Canadian Vickers, Lt., Montreal. Mr. Griffith has been acting as sales manager for Griswold & Co. for the hydro-electric and mechanical lines, especially the machinery manufactured by Brown, Boveri and Co. Ltd., of Switzerland.

Obituaries

LEON P. FEUSTMAN, vice-president of the Worthington Pump and Machinery Co., and president and director of many other corporations, died on April 7 at his home in New York. He was 66 years old.

T. S. SLIGH, JR., physical research engineer of the Studebaker Corporation, South Bend, Ind., and formerly with the United States Bureau of Standards at Washington, killed himself accidently on March 31 while cleaning a revolver. He was 35 years old.

Calendar of Local Meetings

Society of Automotive Engineers

Metropolitan Section. April 21. Subject: "Highways and Vehicles," by Dr. T. R. Agg, Iowa State College.

Dayton Section. April 21. Subject: "Recent Developments in Lighter-than-Air Craft," by Dr. Karl Arnstein, Goodyear Zeppelin Co.

Detroit and A.M.A. Section. April 28. Co-operative dinner. Speaker: C. F. Kettering, General Motors Corporation.

National Association of Cost Accountants

Buffalo Chapter. April 28. "Wage Incentives and Their Effect on Comparative Costs," by J. H. Paterson.

Chicago Chapter. April 21. "The Administrative Use of Standard Factory Costs," by B. R. Wells.

Detroit Chapter. April 28. "Cost Accounting as a Basis for Industrial Research," by E. R. Weidlein.

Hawaii Chapter. April 26. "Actuarial Science," by A. F. Bauman.

San Francisco Chapter. April 25. "Cost Accounting to the Banker."

Scranton Chapter. April 26. "Transportation Management," by Earl B. Moffat.

Forthcoming Meetings

American Gear Manufacturers Association. Eleventh annual meeting, Hayes Hotel, Jackson, Mich., May 12 to 14. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society for Steel Treating. Spring sectional meeting, Milwaukee, Wis., May 19 and 20. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Semi-annual meeting, White Sulphur Springs, W. Va., May 23 to 26. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

Associated Machine Tool Dealers. Annual spring meeting at Granville, Ohio, May 25, 26 and 27. Tyler W. Carlisle, secretary, the Strong, Carlisle & Hammond Co., 1392 West Third St., Cleveland, Ohio.

National Foreign Trade Council. Fourteenth national foreign trade convention, Hotel Statler, Detroit, Mich., May 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

Society of Industrial Engineers. Annual meeting, Hotel Stevens, Chicago, May 25, 26 and 27. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer meeting, French Lick Springs, Ind., May 25 to 28. C. E. Heywood, manager of meetings department, 29 W. 39th St., New York City.

American Foundrymen's Association. Annual convention, Edgewater Beach, Chicago, June 6 to 10. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Supply and Machinery Distributors' Association. Twenty-second annual convention with the **Southern Supply and Machinery Dealers' Association,** and the **American Supply and Machinery Manufacturers' Association,** on board the steamship *Noronic.* Boat leaves Detroit, Mich., June 13 and returns there June 17. George A. Fernley, secretary, 505 Arch St., Phila-

Exposition of Engineering Developments. Under the auspices of the Association of Iron and Steel Electrical Engineers, in the Empire Bldg., Pittsburgh, June 13 to 18. John F. Kelly, general chairman, 705 Empire Bldg., Pittsburgh.

American Society for Testing Materials. Annual meeting at French Lick, Ind., June 20 to 24. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Builders' Exposition. First annual machine tool exposition, conducted by the National Machine Tool Builders' Association, at the West Annex of the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, chairman of the exposition committee. Roberts Everett, manager of the exposition, 225 West 34th St., New York. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Bldg., Cincinnati, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

PRICE changes of the week were largely in a downward direction. Fabricated brass and copper declined ¼c. pr lb. in New York, Cleveland and Chicago warehouses, following the recent softness of the non-ferrous metal market. The drop of 25c. per ton in foundry coke shows just how seriously the current bituminous miners' strike is being taken. Demand is improvin for steel structurals and large size pipe at Western points. Slackness has developed in pig iron and soft steel bars. Steel prices show no indication of increased firmness; mills, however, are stocking ingots against a possible emergency in the fuel situation.

(All prices as of Apr. 15)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$22.19
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	27 17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	23.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.00@4.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.15@2.25	3.50	3.25	3.89
No. 12	2.20@2.30	3.55	3.30	3.94
No. 14	2.25@2.35	3.60	3.35	3.99
No. 16	2.@352.45	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.60@2.70	3.75	3.25	4.00
No. 22	2.75@2.85	3.90	3.40	4.15
No. 24	2.80@2.90	3.95	3.45	4.20
No. 26	2.90@3.00	4.05	3.55	4.30
No. 28	3.05@3.15	4.20	4.70	4.45
Galvanized				
No. 10	2.95@3.05	4.10	3.95	4.25
Nos. 12 to 14	3.05@3.15	4.20	4.05	4.35
No. 16	3.15@3.25	4.30	4.15	4.45
No. 18	3.30@3.40	4.45	4.30	4.60
No. 20	3.45@3.55	4.60	4.45	4.75
No. 22	3.50@3.60	4.65	4.50	4.80
No. 24	3.65@3.75	4.80	4.65	4.95
No. 26	3.85@3.95	5.05	4.90	5.20
No. 28	4.10@4.20	5.30	5.15	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	¾	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or								
.125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	4.50	6.00@7.50	4.65
Spring steel (heavier)	4.00		4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.75 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 5/32, 8.35c.; ¼, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@½-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic, up to carlots, New York			14.25
Tin, pigs, 5-ton lots, New York			69 75
Lead, pigs, up to carlots, E. St. Louis	7 00	New York	7 87½
Zinc, slabs, up to carlots, E. St. Louis	6 40	New York	7 37½

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	13.50@14.00		15.00
Copper sheets, base	21.75	21.75	21 75
Copper wire, base	18 50	18.37½	15.00
Copper bars, base	21.37½	21.37½	21.37½
Copper tubing, base	23 75	23 25	23 75
Brass sheets, high, base	18.12½	18.12½	18.12½
Brass tubing, high, base	23 00	23 00	23 00
Brass rods, high, base	15.87½	15.87½	15 87½
Brass wire, high, base	18.62½	18.37½	18.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	26@27	26.02
Zinc sheets (casks)	13.00	12 30	11 36
Solder (½ and ½), (case lots)	42.00	43.75	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade	87.00		
Commercial genuine, intermediate grade	61.00		
Anti-friction metal, general service	31.50		
No. 4 babbitt (f.o.b.)	13.50		
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00 Electrolytic 39.00 Shot	36.00		

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.50 @11.75	10.75	10.75 @11.25
Copper, heavy, and wire	10.75 @11.25	11.00	9.75@10.25
Copper, light, and bottoms	9.25 @ 9.75	9.50	8.75@ 9.25
Heavy lead	6 12½@ 6.37½	6.25	6.00@ 6.50
Tea lead	4.50 @ 4.75	4.25	4.75@ 5.25
Brass, heavy, yellow	7.25 @ 7.50	7.50	6.75@ 7.25
Brass, heavy, red	9.25 @ 9.50	9.50	9.00@ 9.50
Brass, light	5.50 @ 5.75	6.00	6.00@ 6.50
No. 1 yellow rod turnings	7.50 @ 8.00	7.50	7.00@ 7.50
Zinc	4.12½@ 4.37½	4.00	3.25@ 3.75

TIN PLATES—Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9 50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per lb	.02½	.02	.02¼
Roll sulphur, per lb	.02¼	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	.83½	.93	.83
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.55	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	.33	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.1587½	.1612½	.1662½
Solder (½ and ½)	per lb.	42	.425	.4012½
Cotton waste, white	per lb.	.10@13½	.13@.17½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.33	.33	.35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in.	off list	45%*	40%	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville,	3.25@3.50
Coke, prompt foundry, per net ton		Connellsville,	4.00@4.50
White lead, dry or in oil,	100 lb. kegs	New York,	15.25
Red lead, dry,	100 lb. kegs	New York,	15.25
Red lead, in oil,	100 lb. kegs	New York,	16.75

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Broken Kegs or Cases	Full Kegs or Cases
Machine bolts, square heads and nuts:		
Up to ¾ x 6-in	50%	50–10%
Larger up to 1 x 30-in	45%	50%
1¼ and 1½ in. dia	30%	35%
Carriage bolts:		
Up to ½ x 6-in	50–10%	
Larger sizes	50%	
Coach and lag screws:		
Up to ½ x 6-in	50–10%	
Larger sizes	50%	
Tap bolts, hexagonal heads	45%	
Nuts:		
Hot pressed, square and hexagonal, blank or tapped	45%	50–10%
Cold punched, square and hexagonal, blank or tapped	45%	50–10%
Semi-finished, hexagonal, tapped, in packages	40%	
Case hardened, hexagonal, tapped, in packages	30%	
Washers: Deduct from list, per 100 lb.	$1.50	$3.50
Rivets, button and cone head:		
Small, including ⅞-in. dia		50–10%
Large (base) per 100 lb.	$6.50	$5.00

EXTRA per 100 lb. on rivets, for ¼-in. dia., 35c.; ⅜-in., 15c.; 1-in., 5c.; lengths 1 in. and shorter, 25c.; longer than 1-in. up to and including 1½-in., 15c.; longer than 5-in., 25c.; standard countersunk head, 25c.

Machine Requirements and Industrial Construction

Equipment Wanted

D. C., Washington—Bureau of Supplies & Accounts, Navy Dept.—punching and armature winding machines.

Mass., Beverly Farms — miscellaneous tools and equipment for proposed addition to repair and service garage. Estimated cost $40,000.

Mass., Brighton (Boston P. O.)—Scott Bros., Inc., 1-5 Emery Rd.—miscellaneous tools and equipment for proposed garage and repair shop. Estimated cost $40,000.

Mass., Dalton—Byron Webster Co.—machinery and equipment for proposed addition to machine shop.

Mass., Lynn—G. Mendelsohn, Grossman Bldg.—miscellaneous tools and equipment for proposed repair and service garage on Union St. Estimated cost $50,000.

Mass., South Boston (Boston P. O.)—McCulloch Mfg. Co., 200 Old Colony Ave.—heavy duty engine lathe to swing approximately 24 in. over carriage and 8 ft. between centers.

Mass., Swampscott (Lynn P. O.)—M. McDonough, 622 Humphrey St.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $75,000.

Mich., Detroit — Peninsular Stove Co., Fort St. and Trumbull Ave.—foundry and material handling equipment, including conveyors, also equipment for finishing castings and manufacture of stoves for proposed factory.

Mo., St. Louis—Missouri-Kansas Texas Lines, G. E. Scott, Purch. Agt.—list of approximately 65 machine tools including drill presses, grinders, boring machines, milling machines, threading machines, lathes, shapers, radial and upright drills, etc.

O., Columbus—Bd. of Purchases, City Hall, H. C. Cain, Purch. Agt.—quick change gear lathe, 15¼ in. swing 8 ft. bed, and 12 in. four jaw independent chuck.

Que., Montreal—E. Vincent, 6269 De La Roche St.—complete equipment for proposed garage and service station.

Pa., Bethlehem — Polysius Corp., Bethlehem Trust Bldg.—wants names and addresses of firms who manufacture machinery for building concrete roads.

Ont., Paris—Wheeler Needle Works Ltd.—small geared press, weight about 2,000 lb.

Opportunities for Future Business

Ala., Birmingham — The Singer Sewing Machine Co., 410 North 19th St., has acquired a site and plans the construction of a new factory building.

Calif., Los Angeles—Hawthorne Furniture Mfg. Co., 834 Kohler St., awarded contract for the construction of a 1 story, 244 x 294 ft. factory at 59th St. and Central Ave. Estimated cost $125,000.

Calif., Riverside—Riverside School Dist., will soon award contract for the construction of a shop for junior high school.

Calif., San Francisco—Herbst Mfg. Co., 1525 Mission St., manufacturers of sheet metal products, etc., plans the construction of a 1 story factory at Mission and 11th Sts. Estimated cost $40,000. Architect not selected.

Calif., San Francisco—Metropolitan Furniture Co., 1017 Folsom St., is having plans prepared for the construction of a 2 story factory on 7th St. Estimated cost $40,000. M. I. Schwartz, Nevada Bank Bldg., Archt.

Calif., Stockton — Geiger Iron Works, Scott & Pilgrim Sts., is having plans prepared for the construction of addition to shop. Estimated cost $20,000.

Conn., Bridgeport — Bridgeport Metal Goods Co., Cherry St., is having plans prepared for the construction of a 2 story, 60 x 240 ft. plant. Estimated cost $100,000. Fletcher-Thompson Inc., 542 Fairfield Ave., Archt.

Ill., Chicago—Western Electric Co., 22nd and Kenneth Sts., awarded contract for the construction of a 1 story, 300 x 400 ft. addition to factory. Estimated cost $400,000.

Ind., Anderson—Remy-Delco Corp., C. E. Wilson, Pres. and Gen. Mgr., plans the construction of a 240 x 400 ft. addition to factory.

Ind., Bloomington—Nash Motor Co., 319 North College St., awarded contract for the construction of a 2 story, 85 x 130 ft. machine shop and garage. Estimated cost $40,000.

Ind., Ft. Wayne—Freiberger Bros., Central Bldg., awarded contract for the construction of a plant. Estimated cost $50,000. Pohlmeyer & Pohlmeyer, Archts. Wayne Cylinder Grinder Co., lessee.

Ind., Gary—American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh, Pa., awarded contract for the construction of a mill here. Estimated cost $6,000,000. Private plans.

Ind., Richmond—Belden Mfg. Co., manufacturers of insulated copper wire, awarded contract for the construction of a plant. Estimated cost $205,000.

Iowa—Iowa State Highway Commission, Ames, will soon award contract for the construction of six maintenance garages at Blairsburg, Webster City, Ogden, Jefferson, Newton and Grinnell.

Kan., Kansas City—Gould Casting Co., c/o A. R. Gould, 5256 Vernon Ave., Kansas City, Mo., has acquired the building formerly occupied by the Fairfax Foundry Co., and plans alterations, also construction of building to house electric furnace, here.

Md., Baltimore—American Propeller & Mfg. Co., 220-242 Grindall St., manufacturers of airplane and airship propellers, plans the construction of addition to plant to increase the capacity.

Md., Baltimore — John J. Greer & Co. Inc., C. S. Dell, Pres., 207 West Pratt St., iron and steel, awarded contract for the construction of a 1 story, 123 x 264 ft. warehouse at Ridgely and Ostend Sts.

Md., Baltimore—Lock Joint Pipe Co., W. P. Grow, Mgr. Wilkens Ave. and Millington Lane, plans the construction of addition to plant at Garrison Lane and Pennsylvania R.R. to double the capacity.

Md., Baltimore — Monumental Machine Co., J. W. Sims, Pres., 2505 Elliott St., plans the construction of a 1 story addition to machine shop.

Mass., Brookline (Boston P. O.)—H. M. Rambach, 18 Tremont St., Boston, is receiving bids for the construction of a 1 story, 50 x 195 ft. machine shop at Harvard St. and Alton Pl. here. R. H. Bryant & Son, 334 Washington St., Archts.

Mass., Wellesley (Boston P. O.)—J. E. Lee, 562 Washingon St., is receiving bids for the construction of a 1 story repair and service garage on Linden St. O'Connell & Shaw, 134 Newbury St., Boston, Archts. Noted Jan. 6.

Minnesota—Dept. of Administration & Finance, Capitol, St. Paul, awarded contract for the construction of four maintenance buildings at Morris, Crookston, Willmar and Duluth, Minn. for State Highway Dept. Total estimated cost $297,607.

Mo., Kansas City — Southwestern Bell Telephone Co., 11th and Pine Sts., St. Louis, will receive bids until May 2, for the construction of a 3 story, 120 x 180 ft. and 1 story, 108 x 144 ft. garage at 35th St. and Roanoke Rd., here. Estimated cost $150,000. I. R. Timlin, c/o owner, Archt. W. J. Knight & Co., 903 Wainwright Bldg., Kansas City, Mo., Engrs.

N. J., Newark—F. & W. V. Engelberger Co., 159 Jelliffe Ave., manufacturers of cornices, is receiving bids for the construction of a 1 story, 30 x 100 ft. addition to factory. Estimated cost $40,000. Private plans.

N. J., Newark — Newark Gear Cutting Machine Co., 65 Prospect St., will soon award contract for the construction of a 2 story, 49 x 95 ft. addition to machine shop. Estimated cost $50,000. Bishop & Scudder, 9 Clinton St., Archts. and Engrs.

N. Y., Buffalo — Rome Wire Co., H. Wodtke, Clyde Ave., awarded contract for the construction of a 1 story, 120 x 300 ft. factory on Amherst St. Estimated cost $125,000.

N. Y., Pittsford — A. W. Brandt, Comr. of Highways, Albany, will soon award contract for the construction of a workshop here. Noted Mar. 31.

O., Canton—Berger Mfg. Co., 1038 Belden Ave., manufacturers of sheet metal products, plans the construction of a 1 story, 100 x 350 ft. factory. Estimated cost $100,000 to $150,000.

O., Canton—Union Metal Mfg. Co., 1432 Maple Ave., N. E., manufacturers of metal standards, lighting and punch columns, etc., awarded contract for the construction of a factory. Estimated cost $100,000.

O., Cleveland—New York, Chicago & St. Louis R.R., Prospect Ave. and East 2nd St., awarded contract for the construction of a 1 story, 38 x 213 ft. locomotive repair shop. Estimated cost $60,000. A. C. Harvey, Ch. Engr.

O., Painesville — The Metallic Binding Co. awarded contract for the construction of a 1 story, 150 x 200 ft. factory. Estimated cost $60,000. Private plans.

Okla., Oklahoma City—Crane Co., 836 South Michigan Ave., Chicago, Ill., awarded contract for the construction of a 1 and 2 story, 84 x 180 ft. pipe shop, etc., here.

Pa., Butler—Snow Bros., 108 North Bluff St., will build a 1 story, 60 x 140 ft. planing mill. Estimated cost $50,000. C. P. Hitchens, Columbia Bank Bldg., Pittsburgh, Archt.

Pa., Coraopolis—Russell, Birdsall & Ward, Port Chester, N. Y., manufacturers of bolts and nuts, awarded contract for the construction of a 1 story plant here. Estimated cost $1,000,000.

Pa., New Kensington—General Electric Co., Sprague Electric Division, will build a 1 story, 58 x 235 ft. addition to plant. Estimated cost $50,000. Private plans.

Pa., Philadelphia—Jacob Bloom Co., 1049 Frankford Ave., manufacturers of cedar chests, awarded contract for the construction of a 4 story, 40 x 80 ft. factory, at Frankford and Wildey Sts. Noted Apr. 7.

Pa., Philadelphia—Union Transfer Co., 1002 Spring Garden, awarded contract for the construction of a 2 story, 39 x 112 ft. machine shop.

R. I., Providence — The White Co., E. Harlow, Mgr., East 79th St. and St. Clair Ave., Cleveland, O., is receiving bids for the construction of a 2 story, 105 x 200 ft. repair and service garage here. Estimated cost $100,000. Private plans.

Tex., Harlington—Nicholson & Ackerson, c/o Chamber of Commerce, plans the construction of a machine shop. Estimated cost $60,000.

Tex., San Antonio—Fox Co., c/o C. Newton, Alamo Plaza, kodak developing, has acquired a site and plans the construction of a 4 story, 90 x 135 ft. factory at 1700 Blk. Broadway. Estimated cost $150,000. Adams & Adams, Builders Exchange Bldg., Archts.

Wis., West Allis—Le Roi Co. plans the construction of a 2 story, 18 x 48 ft. pattern storage building, etc., on 60th Ave. O. P. Willis, Engr.